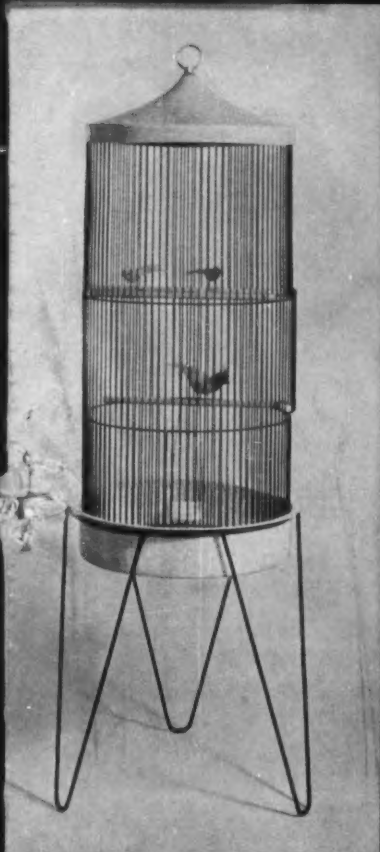
MODERN PLASTICS

mp

December 1956



MODERN PLASTICS*

Volume 34
December 1956
Number 4

Editorial

The Plastiscope

General Section

Plastics Engineering

Technical Section

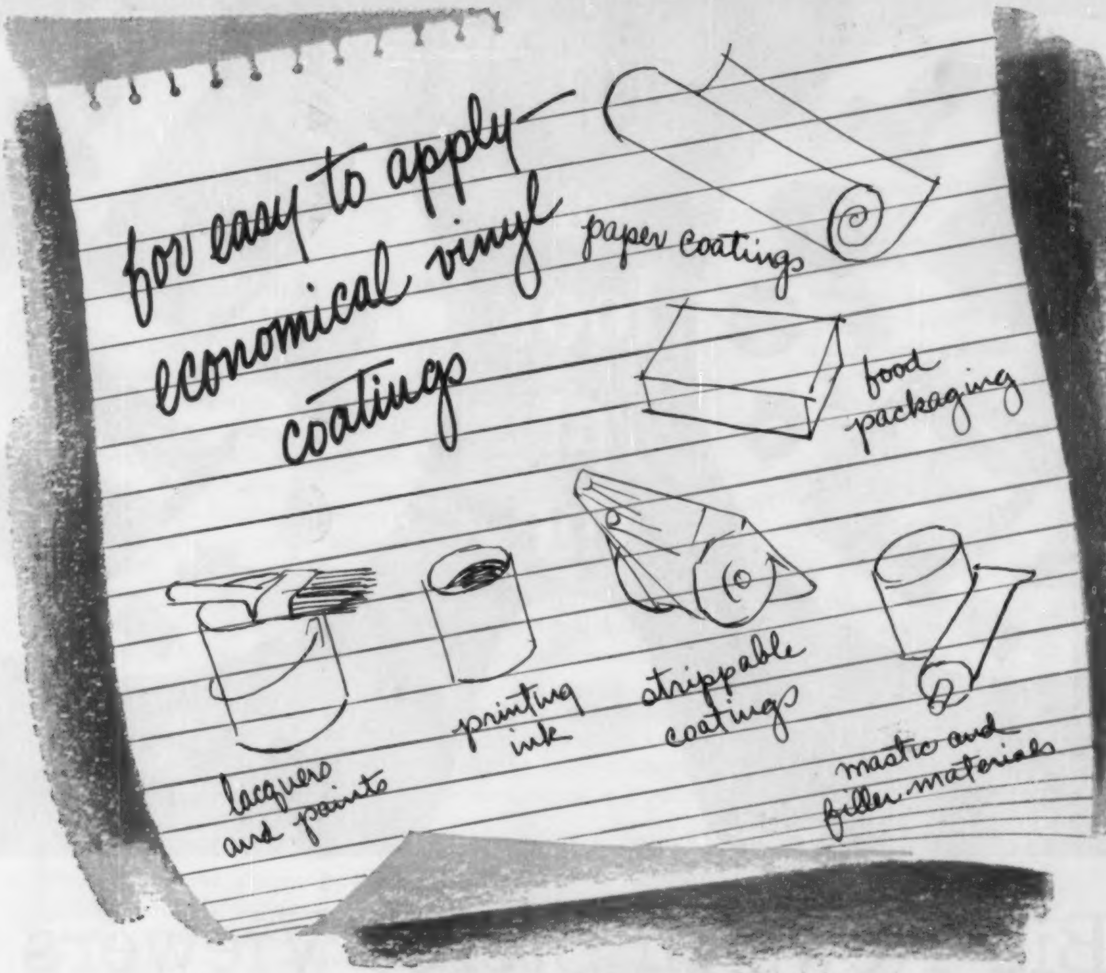
Departments

Modern Plastics Executive and Editorial Offices: 575 Madison Avenue, New York 22, N.Y.

Modern Plastics published monthly by Breskin Publications, Inc., at Emmett St., Bristol, Conn. Modern Plastics Encyclopedia Issue published as second issue in September by Plastics Catalogue Corp., at Emmett St., Bristol, Conn. Second-class mail privileges authorized at Bristol, Conn. Subscription rates (including Modern Plastics Encyclopedia Issue, which is not sold separately), payable in U.S. currency: In United States, its possessions, and Canada, 1 year $7, 2 years $12, 3 years $17; Pan-American countries, 1 year $10, 2 years $17, 3 years $24; all other countries, 1 year $20, 2 years $35, 3 years $50. Single copies $75¢ each (Show issue, $1.00) in the U.S., its possessions, and Canada; all other countries $2.00 (show issue $2.50). *Reg. U.S. Pat. Off.

News about

B.F.Goodrich Chemical *raw materials*



select "tailor-made" GEON SOLUTION RESINS

YOU now have a choice of four Geon polyvinyl resins specifically designed for resin solution application—to provide thin, economical coatings on wood, glass, metal, masonry, paper, and other materials.

ADVANTAGES

- Geon solution resin coatings withstand the effects of most acids and alkalis, salt water, corrosive atmospheres.
- The coatings are odorless, tasteless, non-flammable, and constitute a good vapor barrier.
- Application is very simple and economical—the solutions adhere tightly to surfaces when sprayed, dipped, brushed, or roll-coated.

"TAILOR-MADE" RESINS

A choice of four Geon resin materials permits matching your requirements in terms of function, desired film properties, and cost. For example:

Geon 222—completely soluble in low-cost solvents such as toluene.

Geon 427—general purpose non-reactive resin.

Geon 421—forms tough films with superior low-temperature properties.

Geon 400 x 110—excellent adhesive properties.

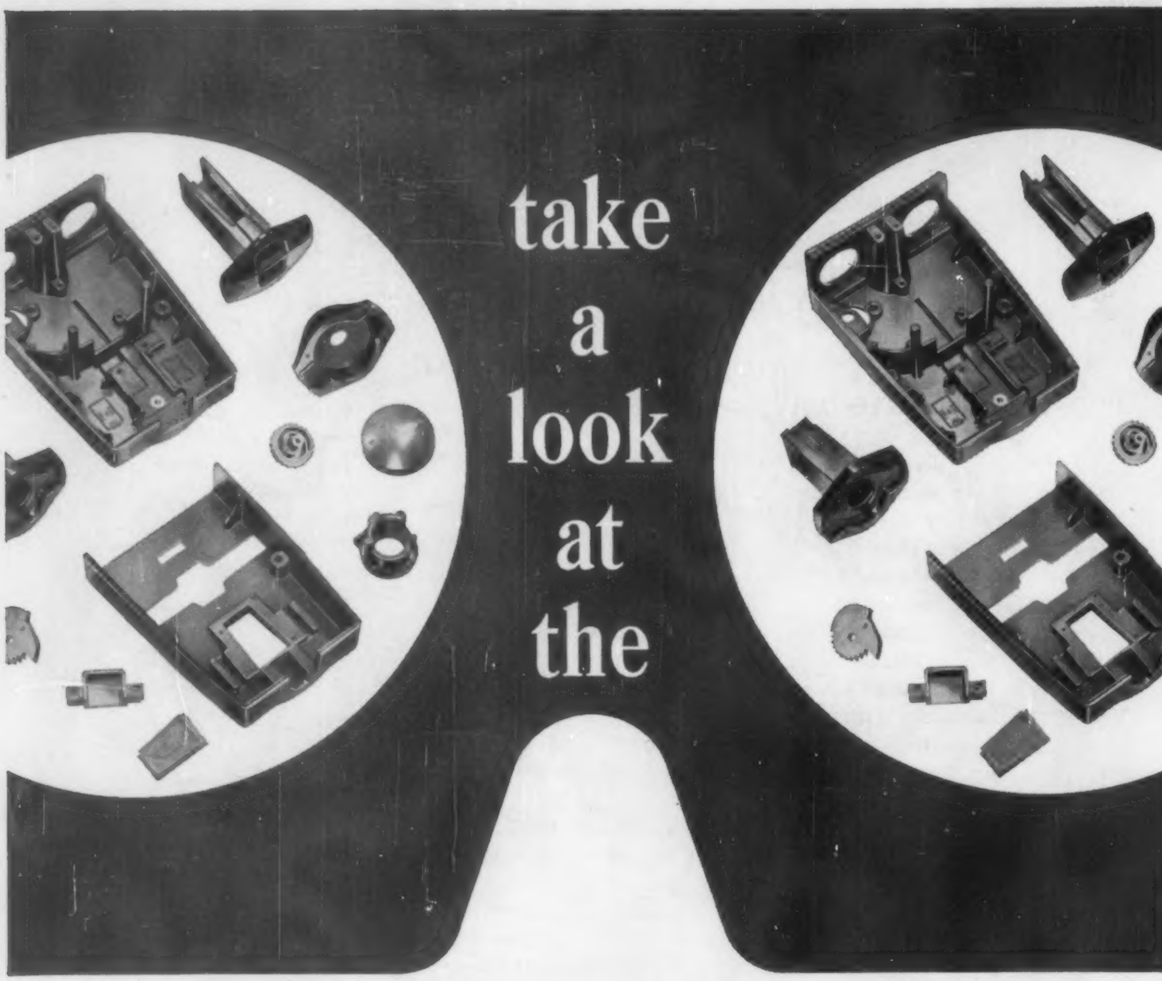
GET THE FACTS

A new booklet "Geon Solution Resins" contains complete technical data and application information. For your free copy write Dept. DS-12. B. F. Goodrich Chemical Company, 3135 Euclid Ave., Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

Geon *Polyvinyl Materials*

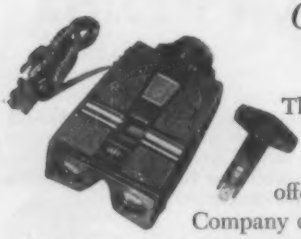
B.F.Goodrich Chemical Company
a division of The B.F.Goodrich Company

B.F.Goodrich GEON polyvinyl materials • HYCAR American rubber and latex • GOOD-RITE chemicals and plasticizers • HARMON colors



Big News in Stereo Viewers

Chicago Molded uses phenolic of top dimensional stability



The new, prestige-building Realist Stereo Viewer at the left is now being offered by the David White Company of Milwaukee, Wisconsin.

It features: optional power for illumination — *either from a light socket or battery;* knob-easy brightness control; a new focusing adjuster; a thumb wheel inter-ocular adjuster that permits each viewer to set the proper distance between eyes.

The viewer is making big news in plastics, too! The eleven parts you see above are all custom molded. For top dimensional stability so vital in precision optical equipment, Chicago Molded has used an improved, compression molded phenolic that is highly impact resistant. For sales appeal and quick product identification six parts are a sprightly green polystyrene. For production economy, all six have been injection molded at one time in a six-cavity mold.

Whatever your new product needs, you'll find *it pays* to call in Chicago Molded. CMPC engineers keep abreast of developments in plastics to help you make your product more saleable, yet less costly. *That's why 60% of our business comes from firms we've served for over 15 years.*

Write today for a free subscription to *Plastics Progress,* Chicago Molded's data packed magazine on up-to-date developments in plastics.

CHICAGO MOLDED PRODUCTS CORP.
1046 North Kolmar Avenue, Chicago 51, Illinois

Editorial

Polyethylene problems

While a great deal of research and field test attention has been paid to the weathering resistance of polyethylene, to the obtaining of clarity in film, and to dispersions of carbon black in polyethylene for pipe, two other problems, believed by some authorities to be related, still await solution.

One is the problem of environmental stress cracking. When a piece of polyethylene pipe or a polyethylene molding is under stress while under attack by chemicals to which polyethylene is normally inert, cracks can occur.

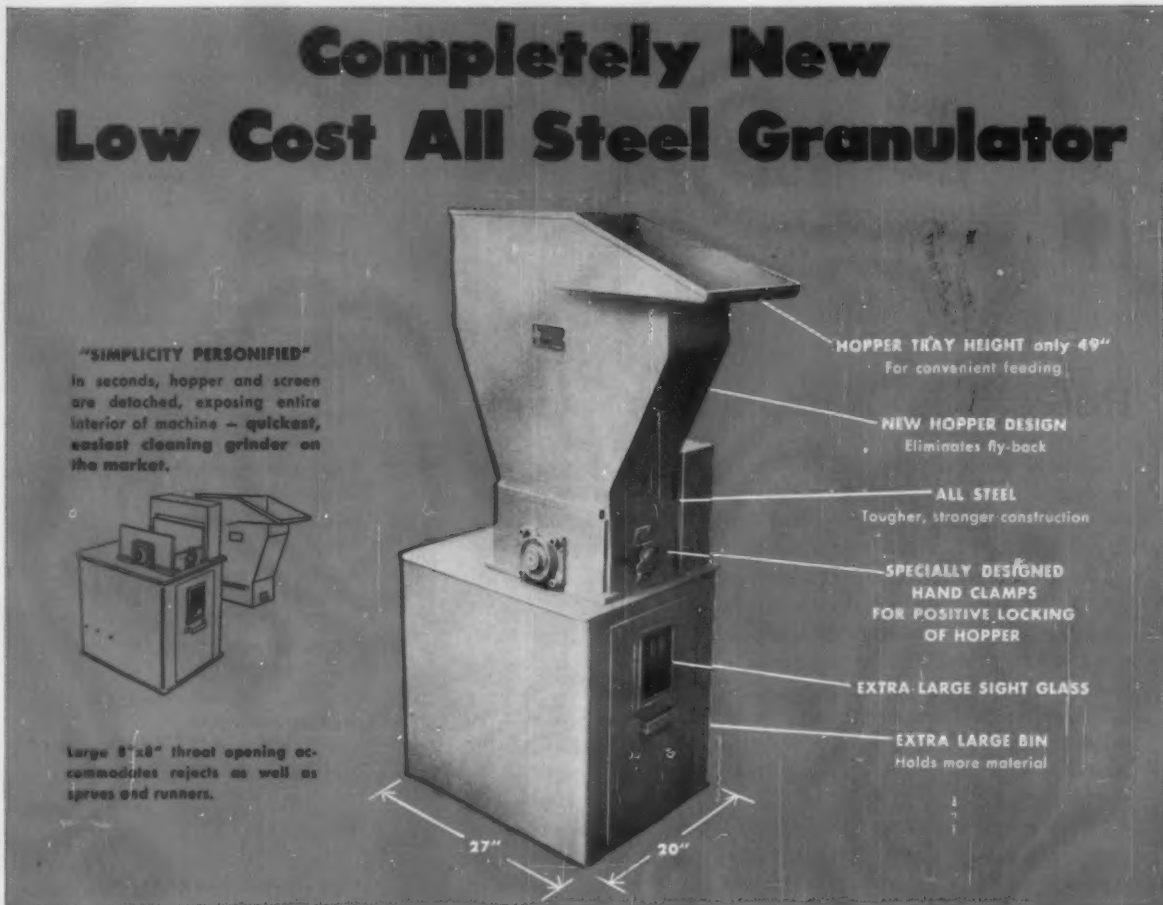
The other problem is that of cold-temperature flexibility of polyethylene to which waxes and other materials have been added in order to provide a high melt index and fast flow for economical molding of large pieces.

There is still considerable confusion even among technologists as to the exact definition of "environmental stress cracking" and as to whether temperature should be considered a factor in that problem or should be considered a separate problem.

Because of the imminent availability of higher-density materials, because of the trend toward blending of different polyethylenes to achieve specific functional and processing properties, and because of the tremendous fields of application opening up for polyethylenes, it is vital to the plastics industry that these problems be clearly defined and thoroughly understood by molders and end users and solved as quickly as possible with the cooperation of all parties concerned.

The solutions are not likely to be simple and will probably force molders to establish their own testing facilities in order to control their blends and to compare materials offered.

There is no point in any level of the industry blaming companies at any other level for the fact that these problems exist and that the solutions are so slow in coming. These are continuing problems increasing in complexity as more types of material are made available and as more applications are developed. All stand to suffer by delay in seeking solutions; all stand to gain by giving attention to these matters.



outperforms any beside-the-press grinder of comparable size and cost

Never before have you been able to get such outstanding performance from a grinder that costs so little. The new B&J M-100 is ideally suited for beside-the-press grinding, and, with its capacity up to 200 pounds hourly, can also be used as a batch grinder. It grinds all plastics, including elastomerics such as polyethylene, without fluffing. Double shear knife action readily cuts hard or soft plastics — hot and cold sprues can be fed simultaneously.

The M-100 is simpler to maintain, simpler to operate, simpler to clean than any machine on the market. Completely enclosed, it stays clean longer. The extra large sight glass shows operator when bin is filled. The extra large bin holds more, slips in and out with ease.

The M-100, first of the MARVEL LINE SERIES of all steel Ball & Jewell Grinders, is backed by the experience which has made Ball & Jewell leaders in the field for over 50 years. Standard equipment includes 1½ HP motor and starter, 2 or 3 HP optional. Casters included at no extra cost.

3 CONVENIENT PAYMENT PLANS
Regular 30-day terms
Deferred Payments
Lease-Purchase Arrangements

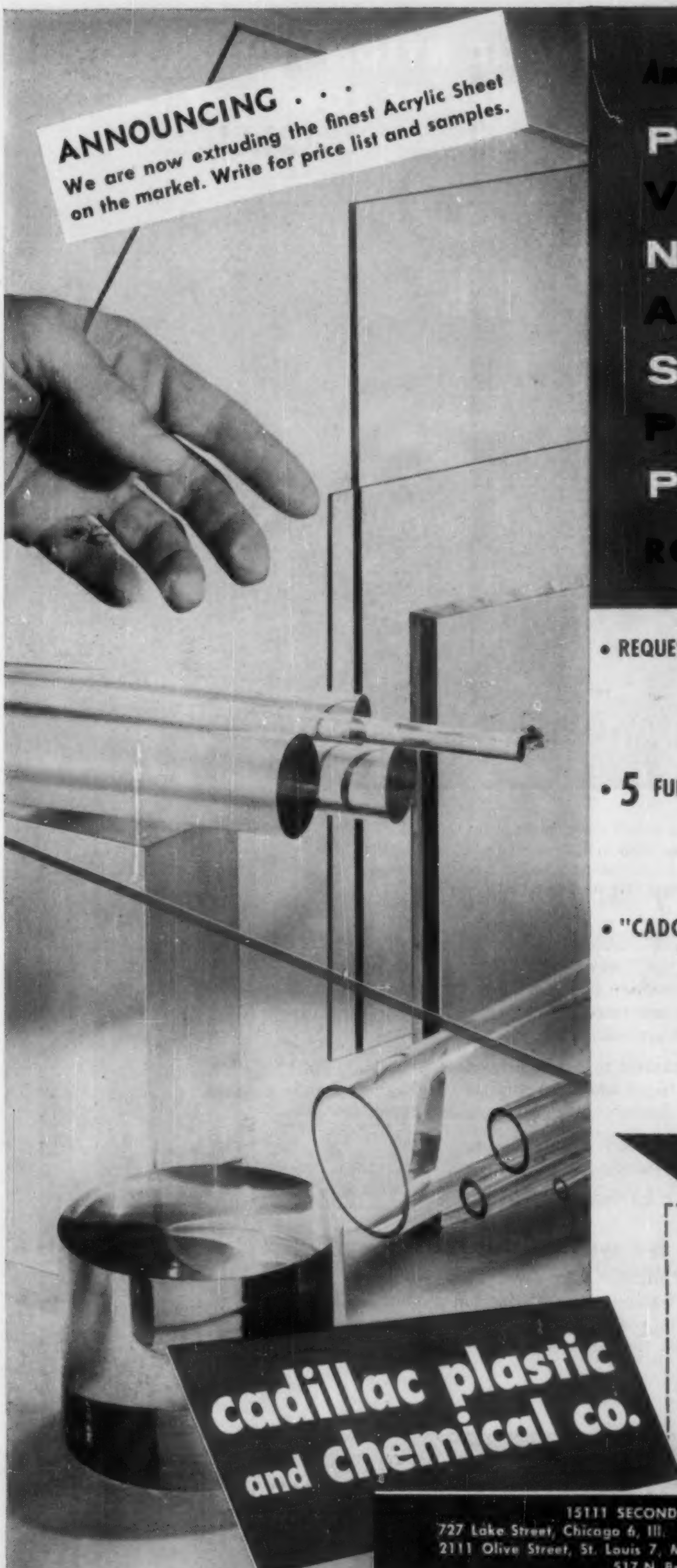
MAKE YOUR OWN 10 DAY TRIAL TEST
WRITE FOR FULL DETAILS

BALL & JEWELL, INC.

22 FRANKLIN STREET · EVergreen 9-6580 · BROOKLYN 22, NEW YORK

Exclusive Export Distributors: Omni Products Corp., New York, N. Y.

B & J HOPPER HEATER-DRYERS • PNEUMATIC MATERIAL DISCHARGE SYSTEMS
EASTERN REPRESENTATIVES—LEWIS INJECTION MOLDING MACHINES


ANNOUNCING . . .
We are now extruding the finest Acrylic Sheet on the market. Write for price list and samples.
cadillac plastic and chemical co.


Beautiful in any form . . .
ACRYLITE, the plastic that's so versatile —so adaptable—its applications are as endless as your imagination.
Acrylite is a non-laminated thermoplastic sheet with embedments of natural leaves, ferns, butterflies, spectacular gold mesh.
Available in sheets of 1/8", 3/16" and 1/4" thickness, Acrylite can be cut or drilled with the same tools you would use in working soft metals. When heated to approximately 325° F. it can be formed into an infinite number of three dimensional shapes.
Write today for literature.
Dealer inquiries invited.
WASCO
PRODUCTS, INC.
Bay State Road, Cambridge 38, Mass.
Wasco Chemical (Canada), Ltd., 3229 Yonge Street
Toronto 12. Ontario

ALATHON® can be molded into toys, such as this tea set, which are safe, attractive and practically indestructible.

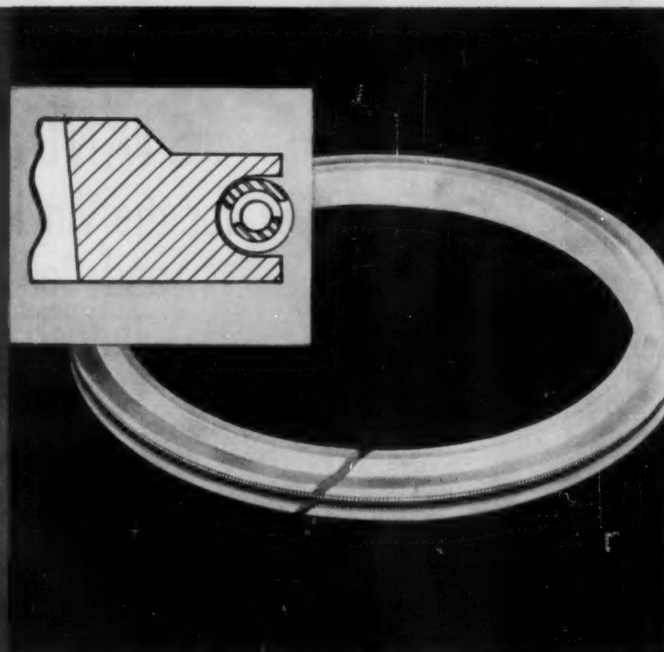
4 more examples

You probably will find, as others have, that you can give your product greater operating efficiency and longer life by making it of Du Pont "Alathon," "Lucite," "Teflon," or "Zytel." The applications shown here are typical of the product improvements possible when design and service requirements are evaluated in terms of the properties of these versatile engineering materials.

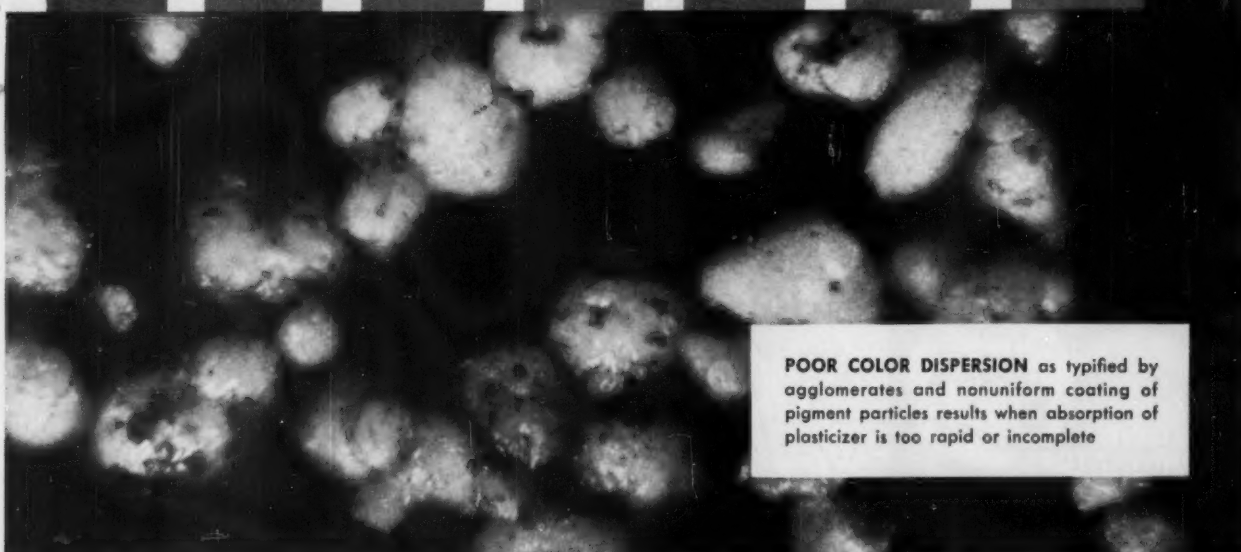
"ALATHON" polyethylene resin is being molded into toys that not only pack a load of "child appeal" but are practically indestructible as well. Du Pont "Alathon" is a logical material for making toys. It can be economically molded into complex shapes and is water- and shock-resistant. Tasteless, odorless and non-toxic, "Alathon" is strong even in thin sections. The possible applications for "Alathon" are many. It can be made into colorful and shatterproof housewares; extruded into film, pipe and wire jacketing; it is suited to packaging of many kinds. The electrical characteristics and high chemical resistance of "Alathon" recommend its use in industry. (Tea set molded by Ideal Toy Corp., Hollis, N. Y.)

"LUCITE" acrylic resin has sparkling transparency comparable to that of finest optical glass. Rouge containers molded from "Lucite" serve as an excellent point-of-purchase display and are pleasing to the touch. "Lucite" features high impact strength. When considering a material for lighting, signs or decorative purposes, you should

LUCITE® can give added sales appeal to a great variety of products. These transparent rouge containers make excellent merchandisers.



worth following

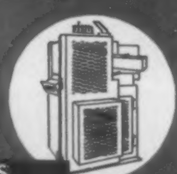


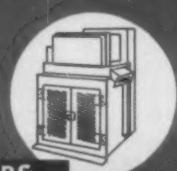
POOR COLOR DISPERSION as typified by agglomerates and nonuniform coating of pigment particles results when absorption of plasticizer is too rapid or incomplete

GOOD COLOR DISPERSION as indicated by uniform deposition of pigment on resin particles results from complete absorption of plasticizer

In Plastics Reducing Machinery, Look to CUMBERLAND for the COMPLETE LINE


GRANULATORS


DICERS


CHOPPERS


PREBREAKERS

"STAIR-STEP" Dicing Machine
CUSTOM ENGINEERED
QUALITY BUILT

1. **PERFECT CUBES** — Perfect cubes or rectangular pellets produced by simply changing knives — cube sizes from $\frac{1}{16}''$ to $\frac{1}{2}''$.
2. **DICES WIDE RANGE OF PLASTIC SHEET STOCK** — Easily handles such materials as polyethylene, soft vinyls, nylon and acetate.
3. **RUGGEDLY BUILT** — In two sizes to handle sheet stock up to 7″ or 14″ — Special machines built to order.

Write for complete details

CUMBERLAND Engineering Company Inc.
BUILDERS OF BETTER MACHINES FOR THE PLASTICS INDUSTRY
PROVIDENCE · RHODE ISLAND

California Representative:
WEST COAST PLASTICS DISTRIBUTORS, INC.
4113 West Jefferson Blvd., Los Angeles 16, Cal.

Strip away five plastisol processing troubles with "Dutch Boy" Stabilizers

...simplify organosol production, too

Stabilize vinyl plastisols with "Dutch Boy" and you go a long way towards solving five common problems.

The first is high heat sensitivity in dispersion resins for plastisols (and organosols). "Dutch Boy" Stabilizers cut this sensitivity down.

Then come three molding problems . . . plate-out of colorants, hard stripping, discoloration from interaction of product and mold. "Dutch Boy" Stabilizers help overcome these three.

Lastly, there's the tendency of stored dipping or spreading plastisols to build-up viscosity. "Dutch Boy" Stabilizers help keep these compounds at best working body.

There are "Dutch Boy" Stabilizers for every plastisol or organosol

Take brightly colored fabric coatings for outdoor use. "Dutch Boy" Dyphos® supplies the ultra-violet screening they need.

Take "clears". Take toys. They call for a stabilizer that gets along well with sensitive plasticizers . . ."Dutch Boy" Provinite.

Take injection molded "opaques". "Dutch Boy" Tribase and DS-207® team up to protect them against high heat.

So it goes. There are "Dutch Boy" Chemicals for every stabilizing problem you may run into with vinyl plastisols or organosols.

For every bodying problem, too! Look into "Dutch Boy" BENTONE® Gelling Agents to improve viscosity in both types of compound.

For more information on "Dutch Boy" Stabilizers and Gelling Agents, write National Lead's Technical Staff.

Dutch Boy® CHEMICALS

NATIONAL LEAD COMPANY

111 Broadway, New York 6, N. Y.

In Canada: CANADIAN TITANIUM PIGMENTS LIMITED
630 Dorchester Street, West, Montreal

Cut Your MIXING Costs!

IMS DRUM TUMBLER

NOW—3 NEW MODELS

FOR QUICKEST, MOST EFFECTIVE DRY COLOR MIXING

Features: **34 RPM — Positive Drive Adjustable Drum Holders**

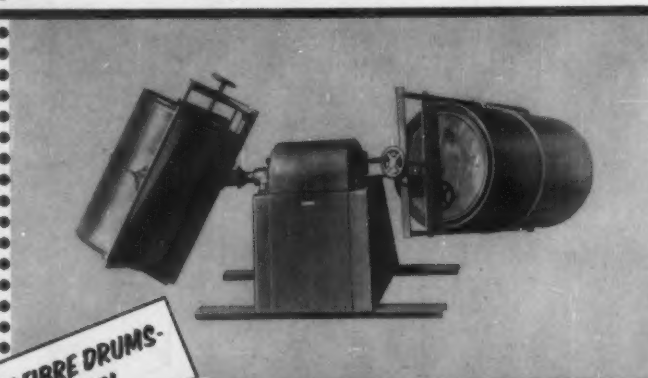
T-2

POPULAR MODEL 3/4 HP

Takes drums up to 33" high, and in all diameters up to 22"

Capacity 150 lbs.

Price, complete with motor $498.50



USE YOUR OWN FIBRE DRUMS-
SAVE CLEANING TIME!

T-2B

HEAVY DUTY 2 HP

Takes drums up to 37" high, and in all diameters up to 23 1/4"

Capacity 300 lbs.

Price, complete with motor $785.00

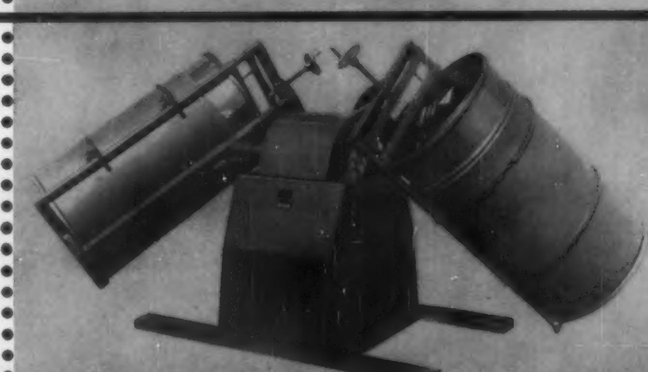
T-2C

EXTRA HEAVY DUTY 3 HP

Takes drums up to 45" high, and in all diameters up to 24"

Capacity 400 lbs.

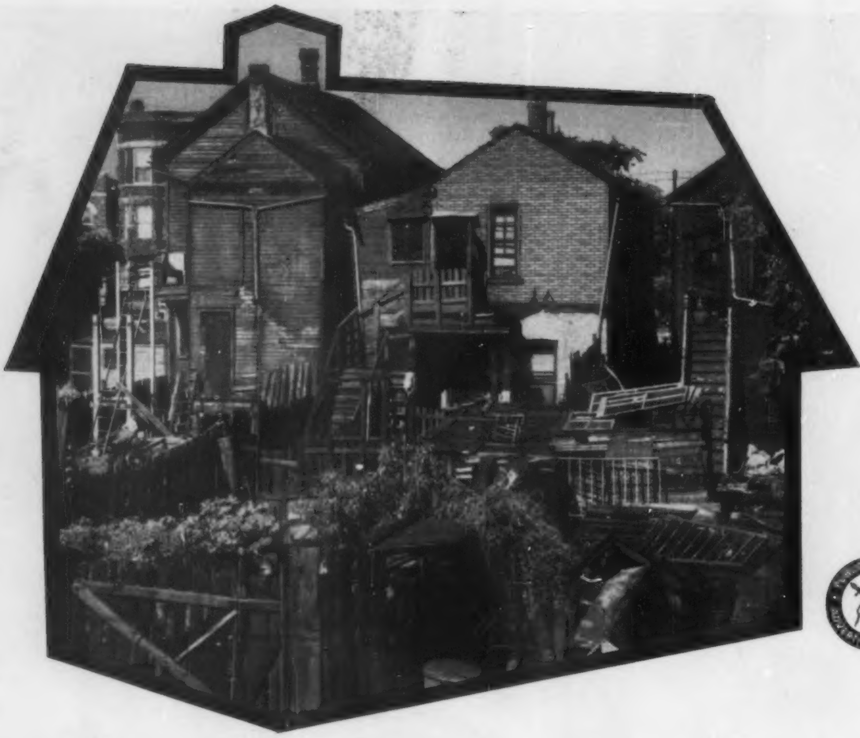
Price, complete with motor $1185.00



INJECTION MOLDERS SUPPLY CO.

3514 LEE ROAD • WYoming 1-1424 • CLEVELAND 20, OHIO

IMS



We have a house to put in order...

WE HAVE A HOUSE to put in order . . . and it's the house where America lives.

Of our country's many million homes, more than 1 out of every 10 are out-and-out slums. Nearly one-half of all American dwellings are in poor to "fair" condition, and urgently need basic repairs.

Something *must* be done—both to correct the slums of today and *prevent* the slums of tomorrow.

How do slums start? Usually just one house starts to slide downhill and soon a whole block changes. Pride is lost. Other houses are neglected, decay spreads.

So the 20 million homes in need of basic repair and improvements deserve equal attention. The time to stop the spreading blight of slums is *before it starts.*

What's your stake in stopping slums?

If you think your town is different, just look around you . . . If you think slums only affect persons who live in them, think again.

Slums raise taxes and lower property values of the whole town. They raise rates of crime, delinquency and disease. *Everyone* has a real stake in stopping slums. And *that includes you as a businessman.*

Your firm is certainly dependent on the welfare of the community where you do business. But it's more than good business—it's good citizenship to take part in efforts aimed at civic improvements. It's the *responsibility* of every business.

What can your firm do? The answer to America's housing problems starts with individuals. But to roll back slums is such a big job it's going to take more than individual effort. It will need the cooperation of your business and many others.

Some slums should be torn down and a fresh start made. Others can be remodeled and made to conform to better living standards. So it is up to you to support every sound program which seeks adequate housing for all our people.

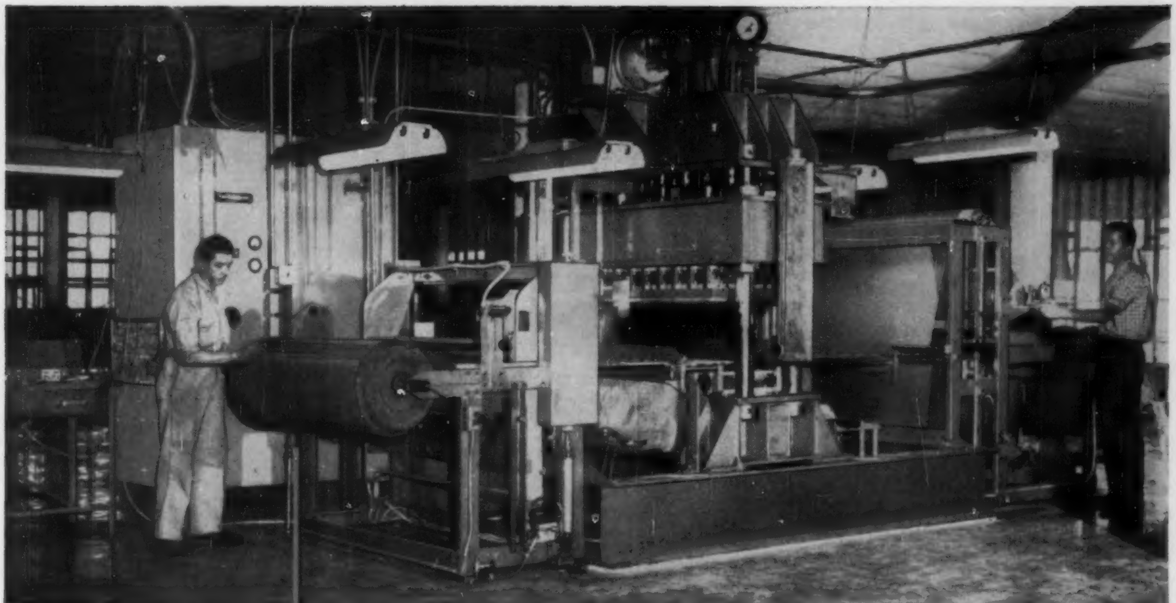
New help is now available

There is a new national, non-profit organization called A.C.T.I.O.N.—The American Council To Improve Our Neighborhoods—which is designed to help all individuals or groups interested in putting America's house in order.

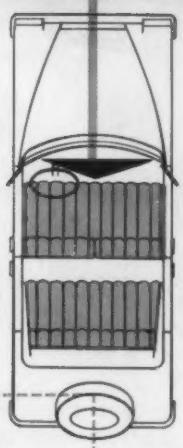
Send for a free copy of "ACTION." It explains what A.C.T.I.O.N. is and proposes to do. It lists booklets, research, check-lists, and other material which can help you. Address P. O. Box 500, Radio City Station, New York 20, N. Y.

ACTION

American Council To Improve Our Neighborhoods



At the Masland Duraleather plant in Philadelphia, sheets of Masland Duran vinyl plastic are electronically welded to a backing, producing a handsome quilted upholstery fabric for automobiles and other uses. The work is done by a large, completely automated Thermatron press in conjunction with a Thermatron generator and indexer. Full rolls of plastic are fed into the press, quilted and rewound in one continuous operation with only supervisory operators.



America's newest cars owe so much to plastics welded by

Thermatron®

HIGH FREQUENCY SEALING AND HEATING EQUIPMENT

Electronically welded plastic products for the automotive industry include . . .

- Door panels
- Upholstered seats
- Safety cushioning
- Convertible tops
- Reservoir bags for windshield wipers
- Interior head linings
- Visor pouches
- Tool kits
- Carburetor filters

You've admired that attractive upholstery in many new cars. It's vinyl plastic, weld-quilted by Thermatron equipment. Then there's the safety cushioning of the sun visors and dashboards. Thermatron does that too—welds and shapes the foam filled visor for more shock resistance.

Because of Thermatron, plastics have become an important part of modern automobile design, and the applications are unlimited. If *you* have a new plastic product in mind, our engineers will be glad to run tests on your own material and make suggestions. Write today to Dept. 111.

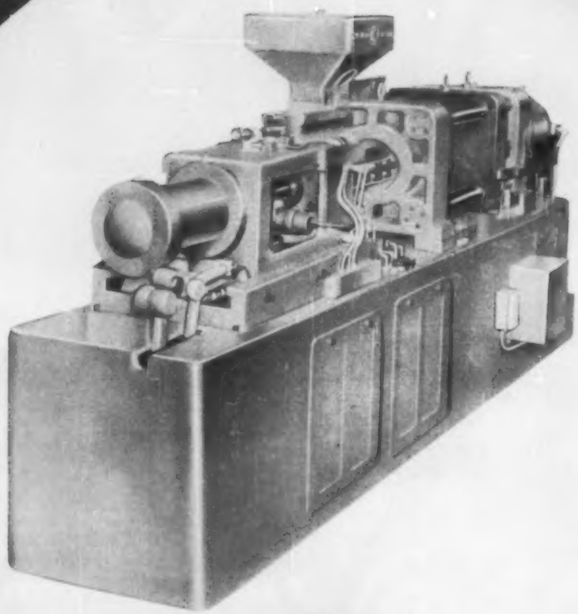
Radio and Electronic Products Since 1922

Thermatron Division

RADIO RECEPTOR COMPANY, INC.

SALES OFFICES: 251 West 19th St., New York 11, N. Y. Telephone: WAtkins 4-3633
Chicago: 2753 West North Ave. Los Angeles 22: R. A. Sperr, P.O. Box 6878
St. Louis 19, Mo. R. E. Fisler, 225 Baker Ave., Webster Groves
FACTORIES IN BROOKLYN, N. Y.

SPECIALIZATION MEANS QUALITY



MEIKI

Specially designed long cylinder assures quick and uniform melting; the cylinder can be easily replaced.

Hydraulic clamping system eliminates troublesome staynut adjustment.

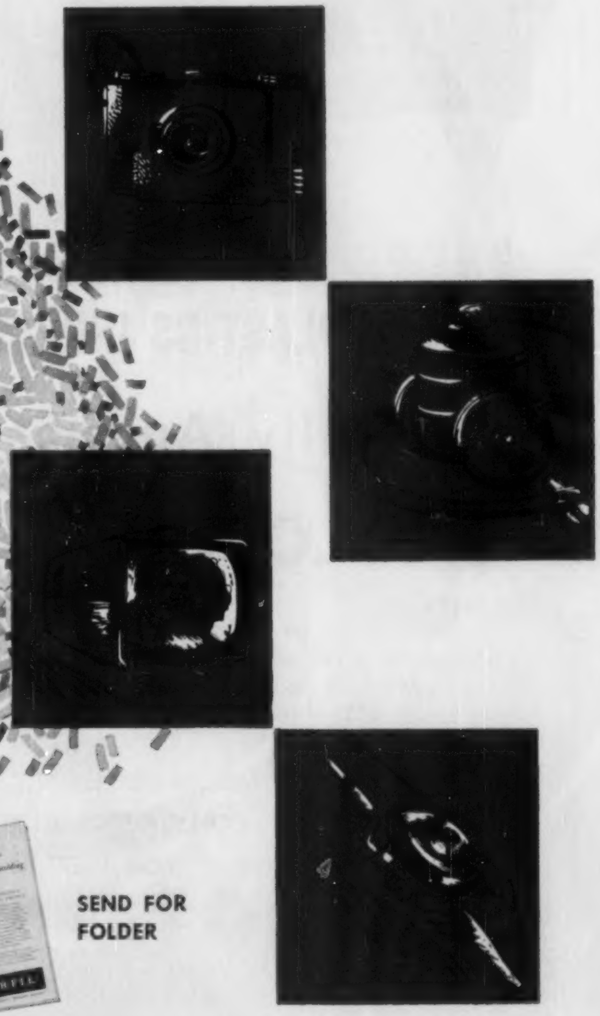
U.S. Standards are adopted on machine parts, European Standards are also available if requested.

Either Meiki hydraulic or Oilgear system can be fitted at your request.

MEIKI CO., LTD.
HYDRAULIC DEPT.
1, 2-chome, Shioiri-cho, Mizuho-ku,
Nagoya, Japan
Cable: **MEIKILTD NAGOYA**

"miracles" BY THE BAG . . .

with FIBERFIL *REINFORCED* INJECTION MOLDING COMPOUNDS



FIBERFIL glass reinforced injection molding compounds are achieving modern "miracles" every day — in hundreds of applications where ordinary plastics have failed.

The remarkable properties of FIBERFIL Styrene G and FIBERFIL Nylon G provide new ruggedness, heat-resistance and extreme dimensional stability never before available to injection molders.

Millions of pounds now being produced and demand is steadily increasing. FIBERFIL is a name *you* will want to investigate.

Write today for descriptive folder listing physical, chemical and electrical properties that you'll find interesting indeed!

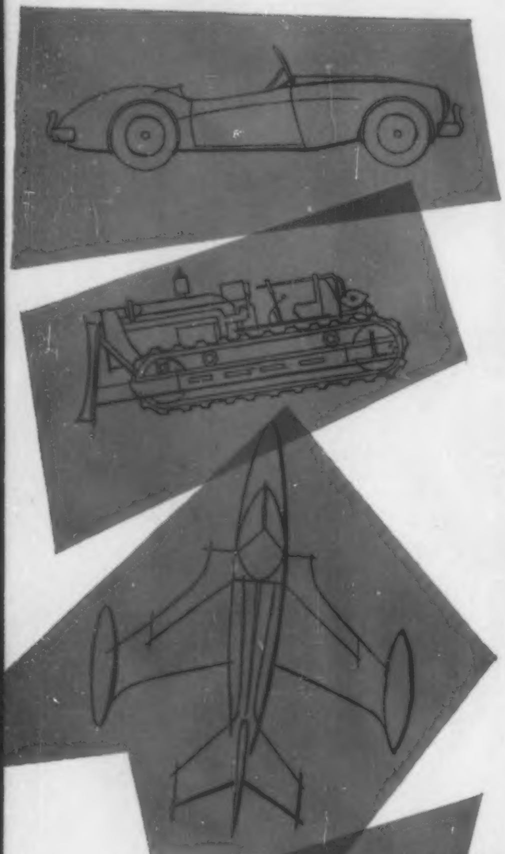
SEND FOR FOLDER

FIBERFIL

Reinforced Insurance for All Injection Molding!

FIBERFIL, INC. • FOX FARM ROAD • WARSAW, IND.


HERCULES
hi-lites on hi-fax
and other Hercules plastics
Specify a Hercules plastic and upgrade your toy products. Now Hi-fax, Hercules' linear ethylene polymer, offers a whole new range of properties for the design and production of better toys: greater strength and rigidity than conventional polyethylene, *plus* rich color and an improved surface finish.
For details on Hi-fax, and other Hercules plastics for the toy industry, please turn the page.
...over...
HERCULES POWDER COMPANY



hi-fax® for toys

Hi-fax, Hercules' new linear ethylene polymer, provides a combination of properties unmatched by any material previously available. That's why those who design or make toys are finding this completely new plastic ideal for a wide range of applications. Check these properties against your requirements and you'll see why Hi-fax means superior products.

Hi-fax is heat resistant—Now plastic toys can be immersed in boiling water, even washed in the automatic dishwasher. A real "plus value" for the mother who always wants baby's toys hospital clean.

Hi-fax is rigid and strong—You get four to five times the rigidity; twice the strength of regular polyethylene. Hi-fax is ideal for those toys that must take it.

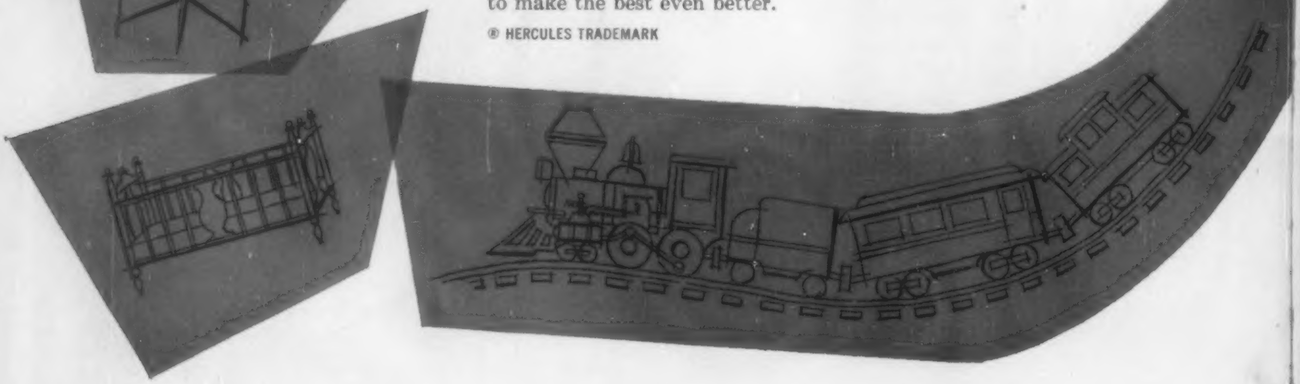
Hi-fax withstands low-temperature—Impact strength remains even at low-temperature. Now plastic toys can go outside in winter.

Hi-fax is richly colorful with an attractive lustrous finish.

Hi-fax is easy to fabricate—Hi-fax toys can be molded by compression, extrusion and injection techniques and machined by conventional methods.

Whether your line is toys or housewares, industrial moldings or electrical insulation—whatever your product, you'll find Hi-fax offers a superior plastic to make the best even better.

® HERCULES TRADEMARK



hercocel® *from head to toe*

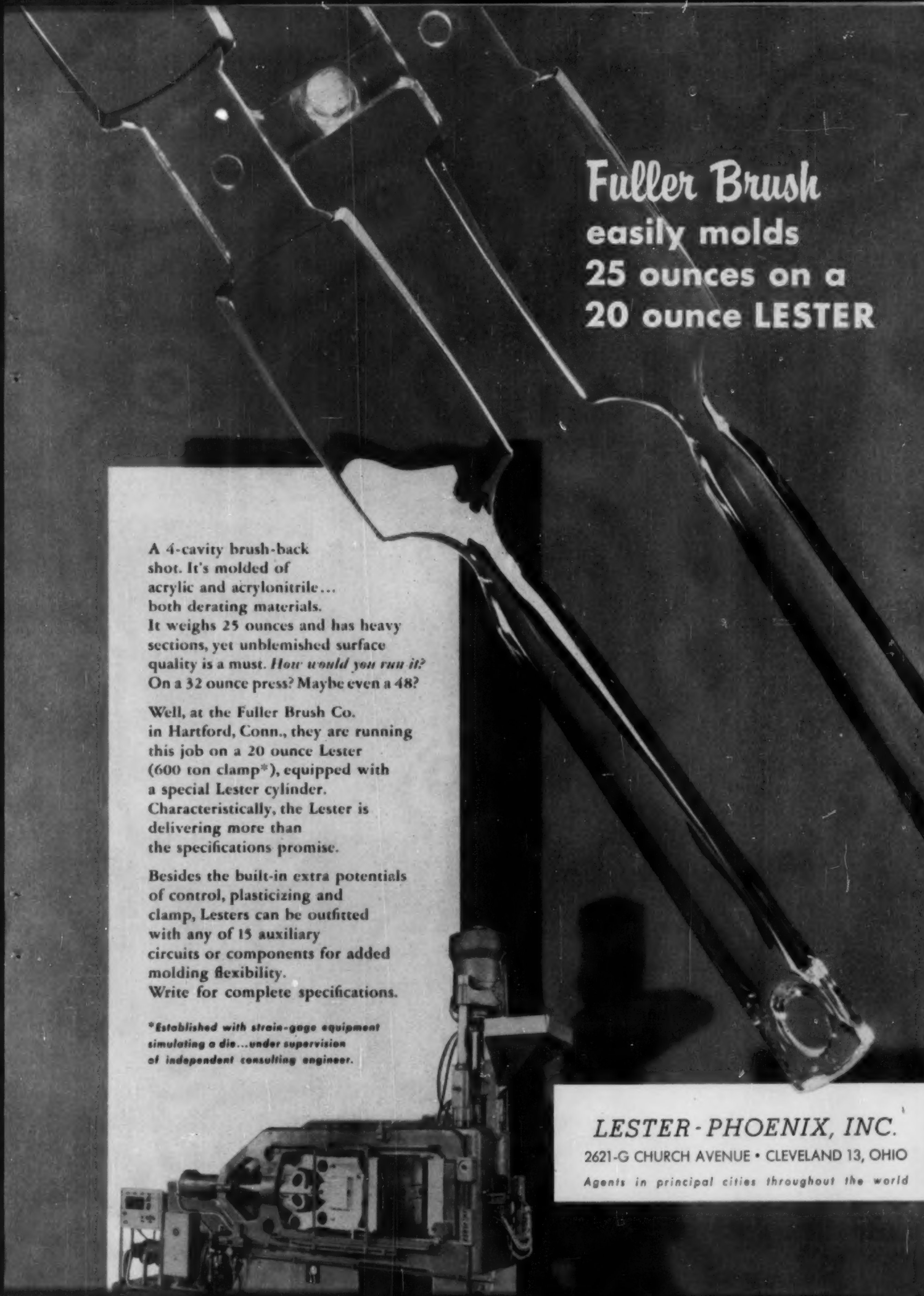
Betsy Wetsy, long a favorite of small girls, poses with her brand new big sister—The Revlon Doll—"The Most Beautiful Doll in the World." Both of these dolls have a lot in common. For one thing they belong to the famous Ideal Toy Corporation family. For another, they both rely in part for their long-wearing durability on Hercules Hercocel (cellulose acetate). Betsy's head is completely Hercocel as are the soles of her big sister's shoes. Many toy manufacturers have come to count on Hercocel for acetate's famed toughness, whether it is needed for a complete product or just a crucial part. (Dolls courtesy Ideal Toy Corp., 200 Fifth Avenue, New York 10, N. Y.)

Cellulose Products Department

HERCULES POWDER COMPANY

INCORPORATED

916 Market St., Wilmington 99, Del.


Fuller Brush
easily molds
25 ounces on a
20 ounce LESTER
A 4-cavity brush-back shot. It's molded of acrylic and acrylonitrile... both derating materials. It weighs 25 ounces and has heavy sections, yet unblemished surface quality is a must. *How would you run it?* On a 32 ounce press? Maybe even a 48?
Well, at the Fuller Brush Co. in Hartford, Conn., they are running this job on a 20 ounce Lester (600 ton clamp*), equipped with a special Lester cylinder. Characteristically, the Lester is delivering more than the specifications promise.
Besides the built-in extra potentials of control, plasticizing and clamp, Lesters can be outfitted with any of 15 auxiliary circuits or components for added molding flexibility. Write for complete specifications.
*Established with strain-gage equipment simulating a die...under supervision of independent consulting engineer.
LESTER-PHOENIX, INC.
2621-G CHURCH AVENUE • CLEVELAND 13, OHIO
Agents in principal cities throughout the world

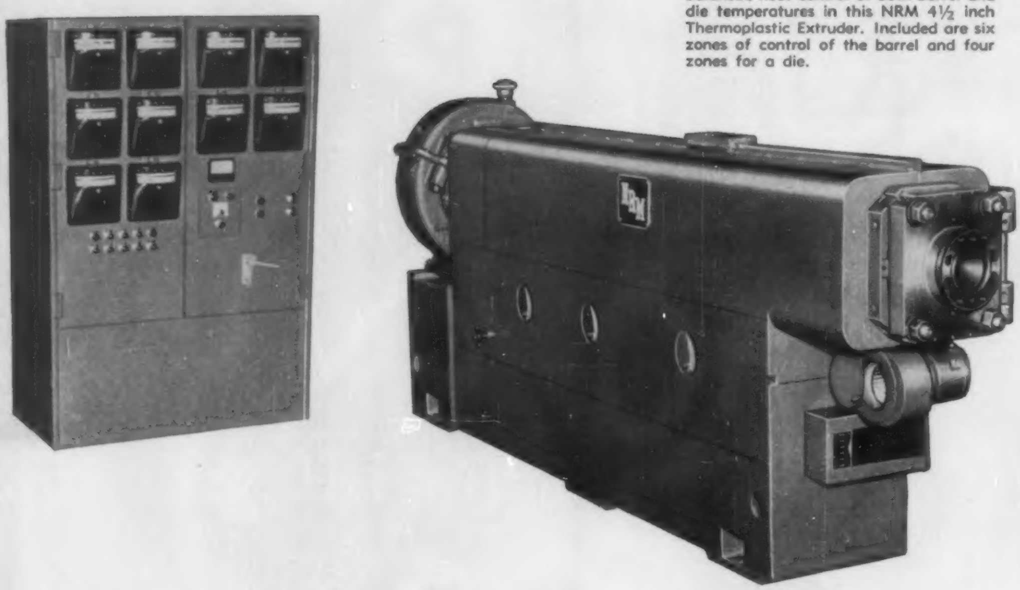
THE MARK OF QUALITY

BARBER COLMAN

Wheelco Instruments

Leading full line of extruders precision-controlled by Capacitrols

Injection, extrusion, and vacuum-forming equipment manufacturers and machine users throughout the country have expressed their preference for Wheelco in the only way that counts — orders and repeat orders. Wherever temperature control instruments are used, you'll find Wheelco!



Electric control cabinet of ten 400 Series Wheelco Capacitrols maintains precision-balanced heat control of both barrel and die temperatures in this NRM 4½ inch Thermoplastic Extruder. Included are six zones of control of the barrel and four zones for a die.

National Rubber Machinery Co., Akron, Ohio, relies on accurate, convenient Wheelco Capacitrols for the "balanced-heat-control" feature so important to the wide range of users served by the outstanding full line of NRM Thermoplastic Extruders.

For example, many of NRM's carefully designed and constructed electric control cabinets are built around a battery of Model 400 Series Capacitrols such as are seen above. Sensitive, no-drift control is assured with these instruments. Model 402 gives anticipatory time-proportioning control; Model 407 a precise control form for smoothly and "steplessly" proportioning electrical power input in accordance with system demand. Other models of the series have other special advantages, and NRM control cabinets often involve two or more types to meet varying needs from zone to zone through the extruder. Model 400 Series Capacitrols are completely self-contained, direct-deflection-type indicating controllers. They are adapted easily to control requirements of plastic packaging and forming machines, as well as injection molding and extruding machines. Send today for Bulletin F-6485, "Capacitrols for the Plastics Industry"!

WHEELCO INSTRUMENTS DIVISION **Barber-Colman Company**

DEPT. L, 1517 ROCK STREET, ROCKFORD, ILLINOIS
BARBER-COLMAN of CANADA, Ltd., Dept. L, Toronto and Montreal, Canada

CHAIN REACTION—The chain link bearings of this woodworking machine—manufactured by Curt G. Joa, Inc., Sheboygan Falls—have helped make the machine perhaps the most outstanding of its kind on the market today. The bearings are made of a graphitized phenolic laminate called INSUROK.® Produced by the Richardson Company, INSUROK is a self-lubricating material that has proved especially adaptable wherever oil lubrication might be difficult or harmful. One of the components employed in the manufacture of INSUROK is Mount Vernon duck.

This is another example of how fabrics made by Mount Vernon Mills, Inc. and the industries they serve, are serving America. Mount Vernon engineers and its laboratory facilities are available to help you in the development of any new fabric or in the application of those already available.

UNIFORMITY Makes The Big Difference In Industrial Fabrics

Mount Vernon Mills, Inc.

A LEADER IN INDUSTRIAL TEXTILES

TURNER HALSEY COMPANY *Selling Agents*

Main Office: 40 Worth Street, New York, N.Y.
Branch Offices: Chicago • Atlanta • Baltimore • Boston • Los Angeles

Branch Offices: Chicago • Atlanta • Baltimore • Boston • Los Angeles

Forticel Cabinet molded for Zenith by Plastic Molded Products Company, Chicago

These are the balanced properties that are giving Forticel its reputation as a "designer's plastic."

TYPICAL PHYSICAL PROPERTIES OF FORTICEL

Flow temperature:		
(°C.) (A.S.T.M.)	D569-48	167—178
Specific gravity	D176-42T	1.18—1.21
Tensile properties:		
Yield (p.s.i.)	D638-52T	3380—5020
Break (p.s.i.)	D638-52T	3470—5240
Elongation (%)	D638-52T	56—66
Flexural properties:		
Flexural strength (p.s.i. at break)	D790-49T	6400—8500
Flexural modulus (10^6 p.s.i.)	D790-49T	0.23—0.30
Rockwell hardness:		
(R scale)	D785-51	62—94
Izod impact:		
(ft. lb./in. notch)	D256-43T	2.7—11.0
Heat distortion:		
(°C.)	D648-45T	59—70
Water absorption:		
% sol. lost	D570-42	0.00—0.08
% moisture gain	D570-42	1.5—1.8
% water absorption	D570-42	1.6—1.8

ZENITH *selects* FORTICEL

new Celanese propionate thermoplastic for its all-transistor portable

The heart of the new Zenith 800 is a remarkable 100% transistor circuit that delivers full room power, tone-true reception.

But what first attracts the eye is its satin-smooth, plastic cabinet—molded of the new Celanese thermoplastic Forticel.

Forticel was created and engineered for just such demanding applications ... places where beauty and precision are twin specifications ... where Forticel's qualities of moldability, superb surface finish, high impact strength, form retention and freedom from objectionable odor can contribute to ready consumer approval as well as manufacturing efficiencies.

We urge you to inspect the new Zenith 800 at your favorite radio shop, and see one of the most skillfully engineered circuits in Zenith history ... and one of the most carefully engineered thermoplastics in service today. You will understand why Forticel has been welcomed by the molder and designer, and why it is being specified for an increasing number of famous name products.

Send for Product Bulletin NP-16. Use coupon below.

Celanese Corporation of America, Plastics Division
Dept. 101-L, 290 Ferry Street, Newark 5, N. J.

Send me New Product Bulletin NP-16 on Forticel Plastic.

NAME______________________ TITLE__________

COMPANY______________________

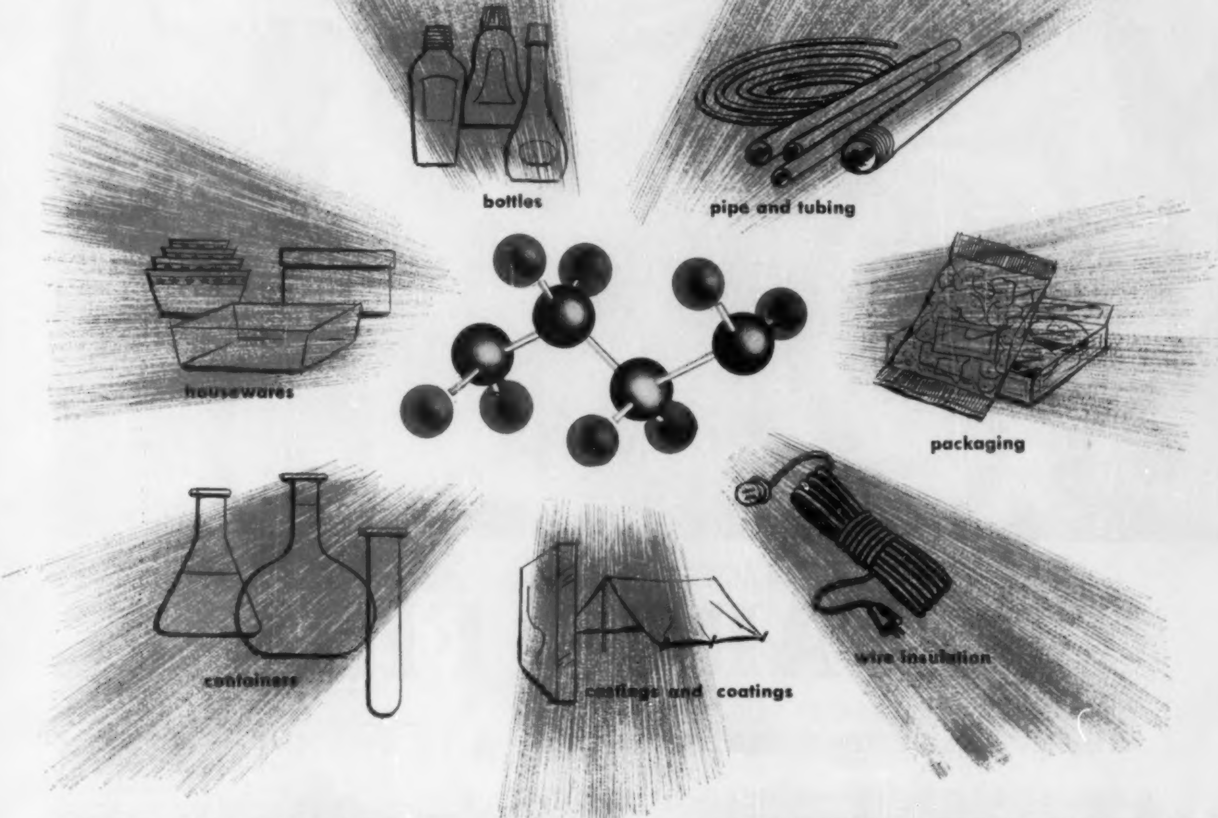
ADDRESS______________________

CITY______________ ZONE______ STATE__________

Celanese
plastics

Celanese® Forticel®

MODULENE*



MAKES IT BETTER!

Whatever you make with polyethylene, Muehlstein's Modulene helps you make it better. For extrusion or injection molding, Modulene's superior properties offer improved product design and lower production costs. It has outstanding low temperature flexibility and toughness, superior chemical inertness, freedom from taste, odor and toxicity, excellent dielectric properties, low specific gravity (.92) and low water vapor permeability. Call on Muehlstein today, and find out how Modulene can improve your product design.

**A Virgin Polyethylene manufactured by Koppers Company, Inc.*

H. MUEHLSTEIN & CO.
60 East 42nd Street, New York 17, N. Y.

REGIONAL OFFICES: Akron . Chicago . Boston . Los Angeles . Toronto . London

WAREHOUSES: Akron . Chicago . Boston . Los Angeles . Jersey City . Indianapolis

RETARDS FIRE

Why you get proved fire resistance, extra strength too—when you design or build with HETRON® polyester

You can buy HETRON polyester sheet right now that carries one or both of these labels.

The Underwriters' label tells you the flame-spread rating of the sheet (as measured by ASTM E84-50T). Now you can classify plastic panels in relation to conventional building materials.

The F-M label tells you that Factory Mutual Laboratories rate this sheet "fire-retardant"—after putting the torch to 2,000 square feet of it on the roof of a building.

The fire-retardant sheet opens up a whole new concept of daylighting for large buildings.

This is only *one* example of what you can do with HETRON polyester sheet or large molded parts.

Some others are: 40-foot boat hulls; 60-foot radomes; aircraft parts; truck fenders; electric insulating board; fire-resistant sandwich panels.

You get HETRON's locked-in flame resistance *without any sacrifice of physicals.* Some designers specify HETRON for its outstanding physicals and molding qualities alone. They get fire resistance as an added bonus.

Still others choose the new *light-stabilized* HETRON resins for high resistance to weathering.

If you'd like more facts on HETRON, consult Sweet's File (Product Design) or Modern Plastics Encyclopedia. For specific test results and names of fabricators who can supply you with HETRON sheet or molded parts, write us today.

Comparative Physical Characteristics

HETRON and 10 non-fire-resistant resins

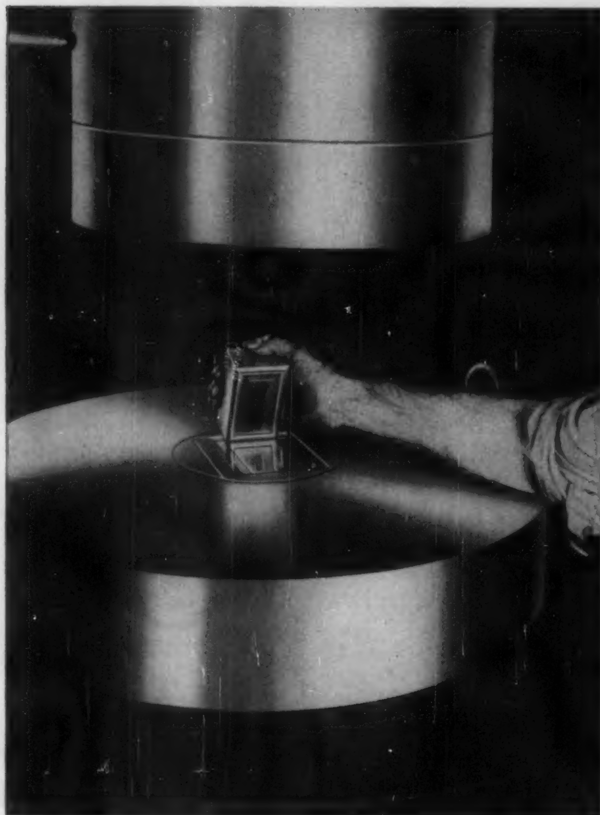
Physical Property		Rigid Resins		Semi-rigid Resins
		HETRON 92	Avg. 10 Others	HETRON 32 A
Flexural Strength, PSIx10^3	Room Temp.	38.6	36.4	41.8
	180°F.	25.0	18.6	23.5
Flexural Modulus, PSIx10^6	Room Temp.	1.88	1.61	1.82
	180°F.	0.90	0.79	0.85
Tensile Strength, PSIx10^3		21.7	22.0	21.0
Water Absorption, Pct. by Wt.		0.13	0.29	0.13

SUPERIOR PHYSICALS of HETRON show up in independent tests on panels 0.1" thick containing 35-40% glass mat, 17-20% filler, and the balance resin.

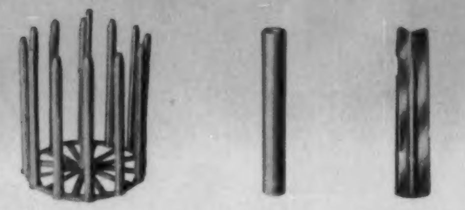
DUREZ® DUREZ PLASTICS DIVISION

HOOKER CHEMICALS PLASTICS

HOOKER ELECTROCHEMICAL COMPANY
3012 Walck Road, North Tonawanda, N. Y.



PENCIL CAVITIES HOBBED IN SOLID STEEL



MOLDED PIECES

HOBBED CAVITY

HOBBED CAVITY CUTAWAY VIEW

SKILLED HANDS

AND

GIANT PRESSES

combine to turn out consistently accurate hobbed cavities

HOB

HOBBED CAVITY

Of course, Newark Die Hobbing and Casting Co. operates a battery of high-capacity presses—up to 3,000 tons—for the making of hobbed cavities.

But even more important than the number and size of hobbing presses is the skill and experience of the craftsmen who operate them. Without this know-how, *a costly hob can be ruined in seconds!*

That is why the skill of Newark Die's craftsmen—men with up to 30 years of experience—is so important to users of hobbed cavities. Newark Die is prepared to make hobbings from your own hobs—or to design and construct the hobs for you.

HOB

HOBBED CAVITY

Write for articles on Solving Big Mold Problems and New Revolutionary Type Injection Molding Machines.

NEWARK DIE HOBBING AND CASTING CO.

22 SCOTT STREET, NEWARK 2, N. J. • PHONE: MArket 2-3305

with... CYCOLAC®

New HIGH-IMPACT THERMOPLASTIC RESIN

THE PERFECT RESIN FOR THE MANUFACTURE OF ANY PRODUCT THAT DEMANDS . . .

- Chemical Resistance
- Lightweight
- Non-Corrosion
- Dimensional Stability
- High Impact Strength
- Machineability
- Economic Molds
- Low Brittle Point
- High Heat-Distortion

Extrusion . . . Calendering . . . Injection Molding . . . It's CYCOLAC for any or all Three Methods

Extruded items for high production of sheet, pipe, or profiles; calendered sheet stock for post-forming operations; injection molded items for high gloss, dimensional stability. All products characterized by high impact resistance, bright colors, chemical resistance, low brittle point, low creep and excellent electrical properties.

Get the Facts...
Write Today for TECHNICAL LITERATURE

Marbon®

MARBON CHEMICAL
Division of BORG-WARNER
GARY, INDIANA

MARBON CHEMICAL . . . *Precision Resins for Precision Made Products*

In sealing, potting and encapsulation—

EPON® RESINS

give excellent electrical, thermal and mechanical properties, plus—

- ✓ excellent dimensional stability
- ✓ high mechanical strength
- ✓ outstanding adhesion to metal, glass, plastics
- ✓ exceptional dielectric properties

Applying Epon resin sealing compound, formulated by Epoxylite Corporation, El Monte, California, to a 400-kva transformer winding at Larsen-Hogue Electric Co., Los Angeles, Calif.

Thoxens Clamp-Coat, an Epon resin cable splicing compound, produces a weatherproof, abrasion-resistant coating with high electrical insulation. Manufactured by Woodmont Products Inc., Huntingdon Valley, Pa.

Although relatively new, the Epon resins have won an important place in electronic and electrical manufacture. Their applications are manifold . . . in printed circuit laminates, transformer and motor sealing compounds, potting compounds for components and subassemblies, protective enamels, adhesives, tool and die materials.

For potting and encapsulating—the excellent dimensional stability of Epon resins, which can, for example, withstand solder bath temperatures without ill effect, and their outstanding adhesion to metals and glass assures airtight enclosure of delicate components and vacuum tubes

As adhesives—solvent-free Epon resin formulations cure at room temperature with contact pressure alone; form powerful bonds between glass, metal, wood or plastic.

As sealing compounds—varnishes and enamels based on Epon resins provide excellent moisture sealing plus outstanding resistance to solvents and chemicals, even at elevated temperatures.

For laminating—Epon resins laid up with inert fibrous fillers produce base laminates that have superior dielectric properties and can be sheared, punched, drilled and bath soldered.

Write for information on the use of Epon resins in electrical and electronic applications.

SHELL CHEMICAL CORPORATION

CHEMICAL SALES DIVISION, 380 Madison Avenue, New York 17, New York

Atlanta · Boston · Chicago · Cleveland · Detroit · Houston · Los Angeles · Newark · New York · San Francisco · St. Louis
IN CANADA: Chemical Division, Shell Oil Company of Canada, Limited · Montreal · Toronto · Vancouver

SHELL

The Plastiscope*

December 1956

News and interpretations of the news

By R. L. Van Boskirk

Section 1

First polyethylene plant on Pacific Coast. Union Carbide's high-pressure-process polyethylene plant at Torrance, Calif., is now on full stream. Initial production started last spring. A former announcement stated that engineered capacity would be 60 million lb. annually. The plant's output will be sold by the Bakelite Div., which can now summon a total announced polyethylene production capacity of 250 million pounds. Since most chemical plants can generally produce more than announced capacity, the total capacity for Bakelite is probably considerably over that amount. And, in addition, the company is building two low-pressure-process polyethylene plants at Institute, W. Va., with a combined capacity of 55 million pounds.

Another increase in high-pressure polyethylene capacity. An increase from an original 26 million-lb. designed capacity for polyethylene to a 100 million-lb. volume by mid-1957 has been announced by National Petro-Chemicals Corp., whose output is sold by U. S. Industrial Chemicals Co. The plant at Tuscola, Ill., is already operating at twice its designed capacity, according to company officials. The new expansion will cost about $10 million.

Significant in the announcement is the statement that a great portion of the new capacity will be used for the new medium-density high-pressure-process polyethylenes of a type similar to that produced by Du Pont and Spencer Chemical. U.S.I. states that densities of from 0.920 through 0.950 can be produced by this new technique, but the company plans at first to concentrate on medium-density ranges. Most high-pressure polyethylene now produced is in the 0.918 to 0.923 density range. Medium or intermediate densities run from 0.930 to 0.940. Low-pressure-process polyethylene of the Ziegler and Phillips types ranges from 0.940 to 0.960. As density goes up so do heat resistance and stiffness. The medium-density producers expect to take over portions of the markets that were once seen as outlets that could be filled only by high-density polyethylene.

The growing giant must be eating vitamins. The above announcements concerning polyethylene mean that the total capacity of high-pressure polyethylene facilities now built or planned will be more than 750 million lb. by the end of 1957. In addition, there are plans afoot for between 500 and 600 million lb. of low-pressure-process polyethylene capacity which producers are hopeful will be on stream before 1960. Production for 1956 may reach 550 million lb., with sales

*Reg. U.S. Pat. Off.

of perhaps 510 million, but 150 million lb. or thereabouts will be exported. In 1955, sales were 350 million lb. and production was 400 million.

Polyethylene pipe in Germany. It is nothing new for plastics to receive unwarranted or untrue wallops from misinformed or partially informed sources, but the recent printed statement that Ziegler low-pressure polyethylene pipe, made from Hoechst polyethylene, had failed (cracked or burst) in Europe was a little below the belt. True enough, it burst, but under extremely high pressure after 10,000 to 12,000 hours of most severe testing procedure. It was an experimental effort to find out whether or not it is possible to give a guarantee for this kind of polyethylene pipe comparable to that offered by German steel pipe manufacturers. A Hoechst spokesman states that no installed Hostalen pipe has failed in service and that a substantial amount is in use.

Anti-oxidant for polyolefin resins. Santowhite Crystals (a long-time standard anti-oxidant in the rubber trade) is receiving increased impetus as an anti-oxidant in electrical grade polyethylene. Meanwhile, extraction data are being submitted for clearance by the FDA for its use in general-purpose polyethylene. A Monsanto product, Santowhite Crystals is a purified dialkyl phenol sulfide. All polyolefins are subject to oxidative degradation to a certain degree, but low-pressure polyethylene is more vulnerable than the older high-pressure types. Hence it is obvious that this anti-oxidant is going to receive more attention as the low-pressure materials grow in importance. Of special significance is that the material appears to be a good anti-oxidant for polypropylene, which is reported to be much more sensitive to oxidation than polyethylene.

NOTE: Santowhite Crystals is not to be confused with Santowhite Powder. They are chemically different—the former far more effective for polyethylene. Both are Monsanto products.

Another new plastic by Du Pont. Development of a new plastic material, Delrin acetal resin, which has an unusual combination of mechanical properties, has been announced by the Polychemicals Dept. of Du Pont. Formaldehyde is the starting material from which this resin is derived. The company states that Delrin has an excellent combination of high tensile strength, toughness, high melting temperature, good fatigue life, dimensional stability, solvent resistance, and resistance to deformation. Tests show Delrin to be suitable for a wide range of engineering applications which require a material able to retain its properties under conditions of high temperature and humidity during an extended time under stress or on exposure to most solvents. It is expected to complement Du Pont's line of Zytel nylon resins, increased capacity for which has been announced.

Engineering studies for a commercial production unit to make Delrin are now under way. Meanwhile, current production knowledge by field tests is being accumulated with resin produced from a pilot plant.

More Mylar polyester film. A 50% expansion for Mylar production at its Circleville, Ohio, plant has been announced by Du Pont. Completion is scheduled for early 1958. The material is growing in usage for electrical purposes, metallic textile yarn, tapes, and as a protective surfacing material for decorative laminations; but the latest application of greatest significance may be in the "cook-and-eat" bag

(To page 49)

The Plastiscope

(*Continued from p. 46*)

where it is laminated to polyethylene to serve as a container for prepared foods that are simply dropped in hot water and warmed up. In addition to the Luchow bag (see MODERN PLASTICS *34,* 136, Oct. 1956), it is now being used for a chicken dinner, with three items to a carton, and for packaging precooked foods such as spaghetti for quick lunch "emporiums." Nothing but a refrigerator and a hot plate to heat the water is needed to store and prepare the food. Another use for this laminate is in a package to prevent discoloration in vacuum and gas packaged low-cost meats.

Zytel 42 now in commercial production. Nylon resin with a viscosity tailored for use in extrusion equipment is now being made in commercial quantities by Du Pont. Production from the new multi-million-lb. Washing Works near Parkersburg, W. Va., which started operation recently, augments pilot plant quantities that have supported end-use development work over the past year. The new material has the same strength, abrasion resistance, and softening temperature as Zytel 101, a resin widely used for injection molding.

Tests by Du Pont customers during the development period of Zytel 42 have resulted in a variety of new applications, some of which have already reached commercial production. These include tubing for an automobile lubrication network which the motorist can actuate by pushing a button (see MODERN PLASTICS *33,* 116, April 1956); as an actuator rod moving inside a retractable auto radio antenna; washers; aircraft grommets; and bearings. The material has also been blow-molded to produce aerosol containers. Film made of Zytel 42 can be laminated to paper, foil, and other films.

Epoxies show steady growth. Estimators say that epoxy resin sales in 1956 will be 23 to 25 million lb. compared to 18 million in 1955 and 12 million in 1954. Structural uses, which include potting, adhesives, and reinforced plastics (mostly tooling), increased from 20% of the total in 1955 to 25% or between 5 and 6 million lb. in 1956. The balance of the output is used for coating resins. Production figures are running 3 or 4 million lb. ahead of sales each year. The Tariff Commission's production figure of 18 million lb. in 1954 is generally considered inflated since it included the production of several firms which bought resin and used it as a modifier of various compounds. In such cases, the pure epoxy resin was reported twice.

Polystyrene foam for pipe insulation. The Mundet Cork Co., North Bergen, N. J., is now molding pipe insulation from Koppers' Dylite expandable polystyrene beads for an air conditioning installation at Idlewild Airport, New York. This is probably the largest foamed polystyrene bead application to date. It involves about 20,000 feet of pipe. The thicknesses of the insulation sections are 1, 2, and 3 in., depending upon the need; the thinnest provides insulation for tempera-

tures of 25° F. and up; the 2-in. for temperatures of 0 to 25° F.; and the 3-in. for temperatures down to —25° F. The new installation is claimed to be more economical than a combined cork and foil insulation which would have been used before the advent of polystyrene.

Other applications for molded polystyrene bead foam now in use are molded drip trays and an insulating shell to fit around the evaporator or freezing compartment of refrigerators. Still another possibility is a molded foam shell to fit around a window air conditioning unit. The foam serves to prevent moisture vapor transmission as well as for insulation purposes.

Improved heat-resistant molding compound. Bakelite has announced a new high-impact, heat-resistant styrene-type molding compound with a heat distortion point in the range of 190 to 195° F. Combined resistance to breakage and warpage by heat is designed especially so that it may be used primarily for electrical appliance housings. It is designated as TMD-5161 and suggested especially for portable radio cases and products that must withstand rough handling under extreme conditions. Available in a range of colors, TMD-5161 is supplied in cylindrical pellets about 0.1 in. in diameter and length.

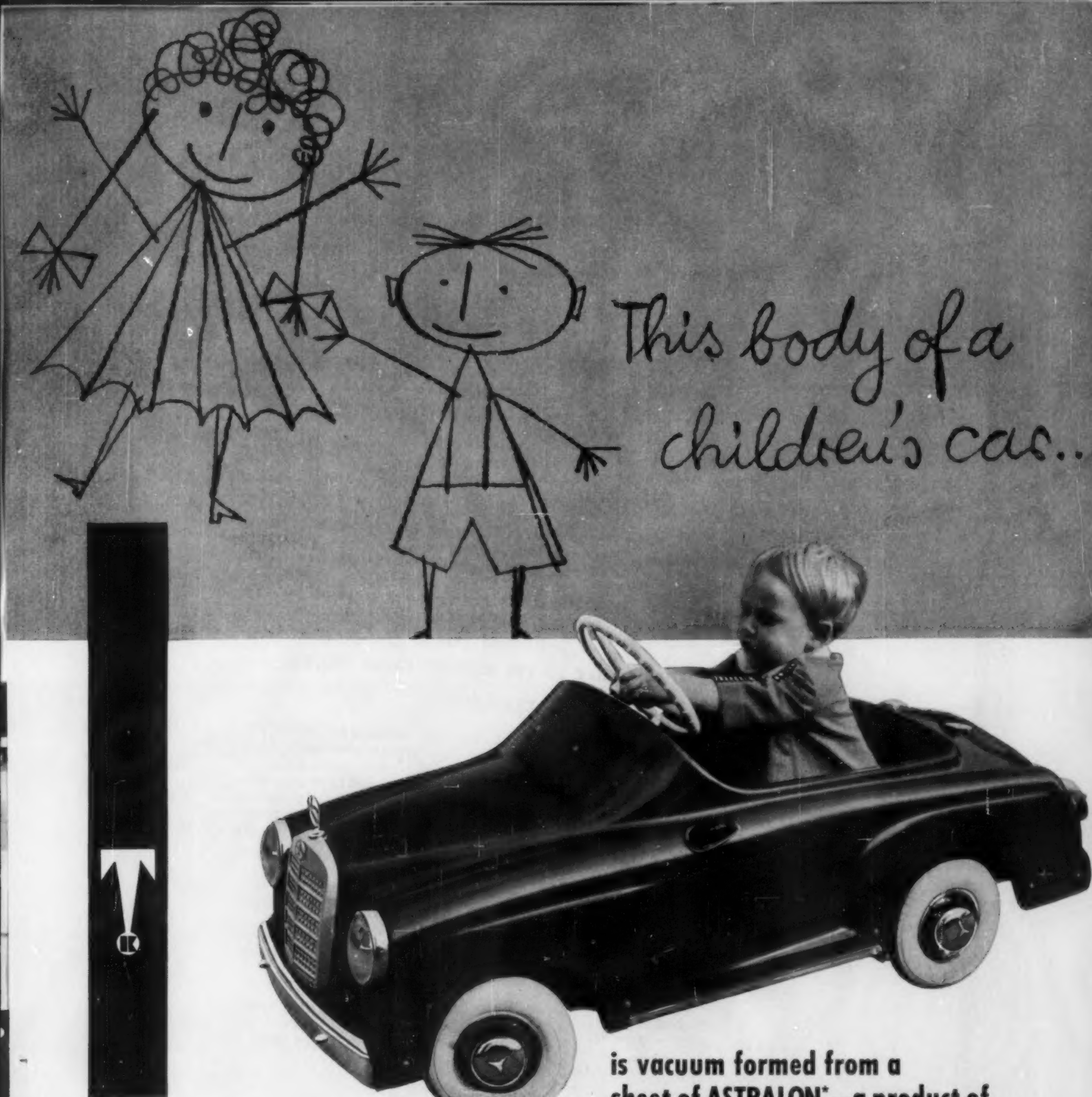
Census report on value of plastics. The preliminary report of the Census Bureau's 1954 Census of Manufacturers says that the value added by manufacture in the Plastics Materials Industry amounted to $585 million, an increase of 190% over 1947. Employment increased 45% since 1947 to a total of 41.6 thousand employees in 1954. The industry shipped products valued at $1242 million in 1954. The cost of materials, fuels, electricity, and contract work increased from $281 million in 1947 to $657 million in 1954. Value added by manufacture is derived by subtracting the cost of materials, etc., from the value of shipments. The "value of shipments" figures cover not only primary plastic products, but also secondary products amounting to $5 million for contract work, sales of scrap, etc. The shipments included $1066 million of plastics materials and $171 million of products primary to other industries such as adhesives and specialties.

The report is very complicated and detailed and should be studied very carefully before its findings are used. The complete report will be available later from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C., as Census Bulletin MC-28B, "Industrial Organic Chemicals."

Sponge plastisols with chemical blowing agents. Sponge plastisols made from vinyl resins and chemical blowing agents have been placed on the market by Stanley Chemical Co., East Berlin, Conn. There are formulations for knifing, roller coating, hot and cold dipping, slush molding, and casting and pressure molding. They may be of both open- and closed-cell construction, either atmospherically or pressure blown, with variations in toughness, compression resistance, and flame resistance.

In slush molding, this material may be used to form an outer skin with a sponge liner if desired. Sponges up to ¼ in. thick may be applied to cloth or paper. It can be applied to handles to give a resilient gripping surface and there is no adhesion problem when it is applied to metal. Stanley also produces conventional plastisols for fabric coating, spraying, dip coating, and slush molding.

For additional and more detailed news see Section 2, starting on p. 266.



is vacuum formed from a sheet of ASTRALON*—a product of Dynamit-Actien-Gesellschaft

***ASTRALON**—a vinyl copolymer—
is available in
these sheet sizes:
24″ x 55″
32″ x 64″
39½″ x 79″

COLORS:
opaque
translucent
(including white)
transparent
(including clear)

PRINCIPAL APPLICATIONS: deep drawing, particularly vacuum forming • surveying and cartography models • laminating identity cards, documents, etc. • name plates, advertising plates • printed instructions, calendars • lamp shades • molds, matrices, etc.

DYNAMIT-ACTIEN-GESELLSCHAFT

VORMALS ALFRED NOBEL & CO.

Abteilung Venditor Kunststoff-Verkauf

Troisdorf/Köln, Western Germany

For full details, contact our U.S. representatives:

GEORG v. OPEL CORPORATION

15 William Street
New York 5, N.Y.
Telephone: HAnover 2-6156-58
Cable: GEOVONOPEL, New York

Robbins PLASTIC MACHINERY CORPORATION

1430 MISHAWAKA STREET
ELKHART, INDIANA
TELEPHONE 3-4060

October 24, 1956

How our "GARDEN GROWS"

To be sure, we would certainly enjoy having each of our customers visit us in our modern Elkhart plant. We would like to tell you person-to-person the complete Robbins "story." Since that is not possible, we felt the next best thing would be to outline a portion of this "story" in a friendly letter through question and answers.

QUESTION: WHAT IS THE ROBBINS SALES POLICY?

ANSWER: WE SELL DIRECT!

Briefly, we sell direct to all extruder manufacturers and chemical corporations for their re-sale to their customers anywhere in the world. We also sell direct to any individual company or corporation regardless of what type of extruder connection they may have with any outside customer. Our primary concern after the initial sale is to offer the supervisory assistance of our trained personnel on the installation of equipment manufactured by Robbins.

QUESTION: WHAT IS THE CORPORATE SET-UP AT ROBBINS?

ANSWER: Robbins is a privately owned corporation. We have no sales agreement or exclusive connection with any extruder manufacturer.

We believe that we are the world's largest manufacturer of extrusion dies and take-off equipment. Our job is to serve you in our own specialized field and to do that job in the very best way possible.

Sincerely,

ROBBINS PLASTIC MACHINERY CORPORATION

Kenneth O Robbins

Kenneth O. Robbins,
President

. . . Monsanto Plasticizers

Special Properties for Nitrocellulose Specialty Coatings

Monsanto offers a wide selection of plasticizers for controlling cost and performance of nitrocellulose coatings. Here are a few examples:

Higher Scuff Resistance . . . Aroclor 1254 builds *hardness* and *toughness* in nitrocellulose films—especially important in heel lacquers that must keep their good looks even when exposed to hard knocks, continual scuffing and abrasion.

Flame Retardance . . . Monsanto phosphate plasticizers such as Santicizer 140 contribute higher flame retardance to nitrocellulose coatings. This is important in many home and industrial uses.

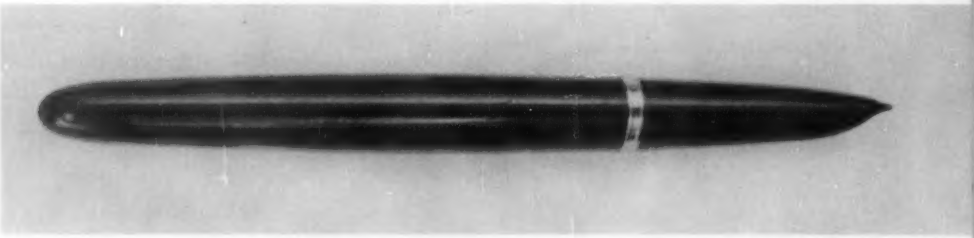
Better Adhesion . . . Better Looks . . . Santolite MHP not only increases *adhesion*—it also improves *brilliance* and *gloss*. Its high *moisture resistance* helps eliminate danger of "water-spotting" of the finish.

You can use Santolite MHP to increase *solids content* of lacquers without changing viscosity. Your customers will like this feature—it means that they can apply heavier films in fewer coats—a real cost-saver.

for Phenolics . . .

More Uniform Dispersing of Fillers

Santicizer 9 features high solvation. In phenolics, it helps disperse fillers (like asbestos) more uniformly. In compression or transfer molding formulations, it improves *flow* and cuts down molding cycles. Results: better product quality and lower costs.



for Polyamides . . .

Quality "Extender" for Nylon . . When you "extend" nylon (or other polyamides) with Santicizer 8, you get much more than reduced raw material costs. *Santicizer 8 reduces the melting points of polyamides.* This is especially important in injection molding because it cuts molding costs. And Santicizer 8 increases *flexibility* and *toughness* in polyamides.

Monsanto Plasticizers

Phthalates
Dibutyl phthalate
Diethyl phthalate
Dimethyl phthalate
Diphenyl phthalate
Dioctyl phthalate
Diisooctyl phthalate
Di-n-octyl-n-decyl phthalate
Diisodecyl phthalate
Santicizer* 160
Santicizer 213
Santicizer 214
Santicizer 602
Santicizer 603
Santicizer 606
Santicizer 611
Santicizer 613

Adipates
Diisodecyl adipate
Dioctyl adipate

Phosphates
Tricresyl phosphate
Triphenyl phosphate
Santicizer 140
Santicizer 141

Phthalyl Glycolates
Santicizer E-15
Santicizer B-16
Santicizer M-17

Sulfonamides
Santicizer 1-H
Santicizer 3
Santicizer 8
Santicizer 9

Sulfonamide Resins
Santolite* MHP
Santolite MS-80%

*Reg. U. S. Pat. Off.

Specialties
HB-40*
HB-20*
Santowax* R
Aroclor* 1221
Aroclor 1232
Aroclor 1242
Aroclor 1248
Aroclor 1254
Aroclor 1260
Aroclor 1262
Aroclor 1268
Aroclor 2565
Aroclor 4465
Aroclor 5442
Aroclor 5460

Building a "new" formulation, re-evaluating an "old" formulation?

. . . Fill out the "Plasticizers Council" card (below) and send it to Monsanto. Your inquiry will receive immediate attention from Monsanto Research and Technical Service teams.

MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, Dept. PL-4, Box 478, St. Louis 1, Missouri

MONSANTO

Please fill in all information that applies to your operation

Base resin now using (including brand name) ____________________

Fabrication method:
Extrusion ____________ Calendering ____________
Injection Molding ____________ Fabric Coating ____________
Plastisol ____________ Surface Coating ____________
Adhesive ____________ Other (please indicate) ____________

Brief description of end-product and production method

____

____

____

Important end-product properties

Specific gravity ____________
Tensile strength ____________
Elongation ____________
Volatility, % weight ____________
% plas. ____________

Low temp. flex and method ____________
Light stability ____ hrs. Weatherometer
____ hrs. Fadeometer
Special properties ____________
Raw material cost ____________ ¢ lb.

Shore hardness ____________
100% modulus ____________
Heat stability ____________ minutes
at ____________ °C.

General notes ____________________

____

____

I would like to have more information on reducing costs through purchasing plasticizers in bulk or combined shipments. I currently purchase the following plasticizers: ____________

____

NAME ____________ TITLE ____________
FIRM ____________
ADDRESS ____________

is Our Business

MANUFACTURED BY
THE AETNA-STANDARD ENGINEERING CO., PITTSBURGH, PA.
PLANTS IN WARREN, OHIO · ELLWOOD CITY, PA.

From sturdy fishing rods to handy soup kitchens!

Pittsburgh Selectron

POLYESTER RESINS

Now Ready For A Thousand New Uses

PITTSBURGH SELECTRON Resins have opened new opportunities for much greater product usefulness with reduced manufacturing costs.

When combined with suitable fillers these remarkable resins have been used to mold products that are lighter than aluminum with strength-weight ratios and impact resistance surpassing those of any other known materials. They also provide unusual resistance to weather, sunlight, heat, abrasion and many chemicals.

That's why SELECTRON Resins are today being used in a wide range of products. These can be as different in size, shape and weight as the new "glass" fishing rods so popular among anglers and the modern displays used in Heinz Fast-Food Kitchens. These displays were designed by the Milwaukee Industrial Designers, of Milwaukee, Wisconsin, and molded by G. B. Lewis, of Watertown, Wisconsin.

SELECTRON Resins are of the thermo-setting type. They polymerize to form solids with or without heat and with or without pressure. Parts in which they are used can be molded either by hand lay-up, direct molding, continuous lamination or pre-forming. These resins can also be used without fibers for casting, potting and impregnating.

We'll be glad to have one of our engineers discuss your problems with you without cost or obligation. This may save you time and money.

Send For FREE Booklet!

Write, wire or phone today for our new booklet containing descriptions of SELECTRON Resins and explaining many of the ways in which they can be used. Pittsburgh Plate Glass Company, Selectron Products Division, Gateway Center, Pittsburgh, Pa.

Just a few products in which Pittsburgh SELECTRON Resins are now used—

Aircraft structural parts
Radomes for electronic equipment
Life floats
Ballistic panels
Helmets
Boat hulls
Machinery housing and guards
Trays
Tote boxes
Food lockers
Garbage pails
Baskets for automatic dishwashers
Baskets for automatic washers
Wash tubs
Tool chests
Shipping containers
Instrument cases
Laundry hampers
Kitchen containers
Fishing rods
Sinks
Street signs
Traffic signs
Fluorescent light fixtures
Television cabinets
Loudspeaker housings
Gas meter housings
Structural panels for offices and homes
Door and transom lights
Awnings and canopies
Greenhouse panels
Skylighting
Molded chairs
Prefabricated houses and garages
Truck bodies

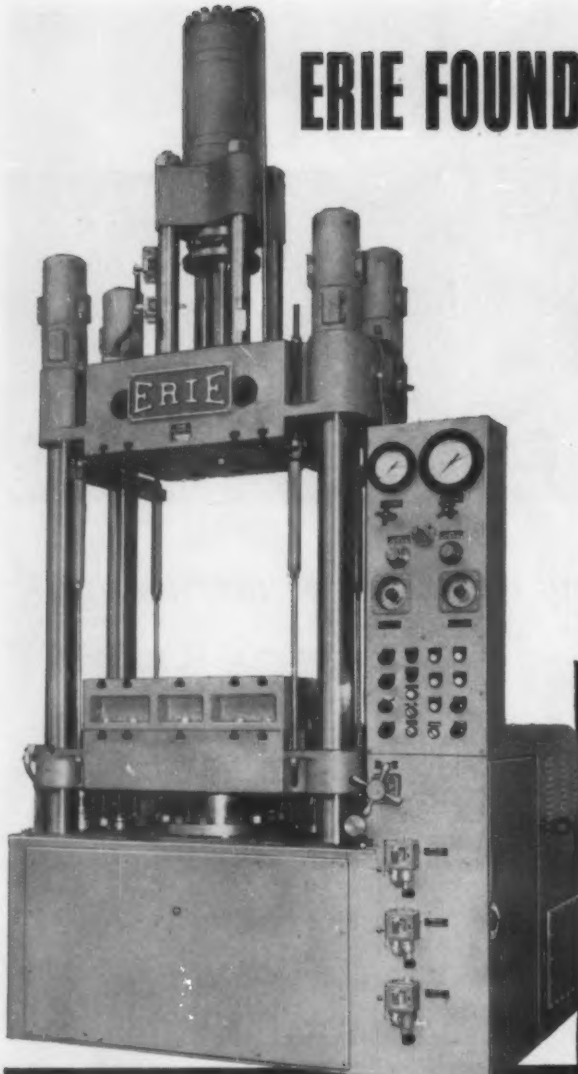
PITTSBURGH Selectron

PAINTS • GLASS • CHEMICALS • BRUSHES • PLASTICS • FIBER GLASS

PITTSBURGH PLATE GLASS COMPANY

IN CANADA: CANADIAN PITTSBURGH INDUSTRIES LIMITED

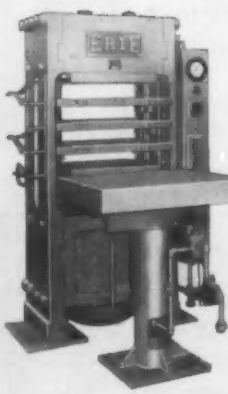
ERIE FOUNDRY HYDRAULIC PRESSES for MOLDING RUBBER and PLASTICS



Hydraulic presses, designed and built by Erie Foundry Company are precision presses in every sense of the word . . . tonnages are accurate and precisely applied, platen temperatures are closely controlled, and molding cycles perform at split second timing. Erie Foundry Hydraulic Presses are flexible too . . . readily adaptable to almost any molding job. Write for complete information on these presses or on the complete line of Erie Foundry rubber and plastic hydraulic presses.

TRANSFER and COMPRESSION MOLDING PRESS

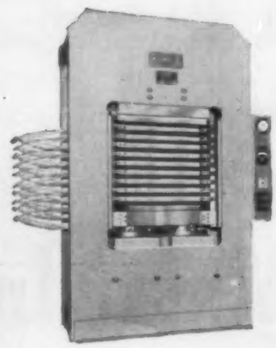
A flexible press for both compression and transfer molding is this 200 ton self-contained semi-automatic Erie press. This machine is equipped with a 55 ton transfer cylinder which can be timed separately from the main ram, as well as knock out cylinders on the bolster and a mechanical knock out for the top mold. Automatic cycling can be easily arranged to mold almost any product.



STRAIN PLATE PRESS for MINIMUM DEFLECTION

The platens stay parallel within .002" on this 314 ton press built of low-stress construction throughout. This press can be converted to transfer molding if desired.

We built the hydraulic lift table, too.



HOT PLATEN PRESS OF ECONOMICAL DESIGN

This 800 ton press is compact and rigid. Accurate platen alignment is maintained with minimum deflection over entire range of platen temperatures.

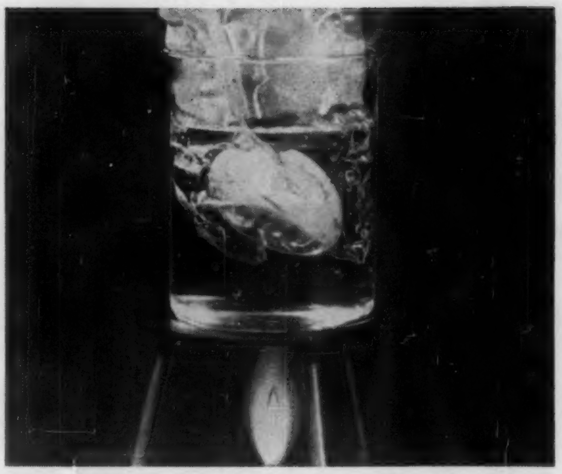
ERIE

Hydraulic Press Division

ERIE FOUNDRY CO., ERIE, PA.

SINCE 1895 THE GREATEST NAME IN HYDRAULIC PRESSES

Now You Can Actually BOIL Polyethylene Film!



Even boiling water can't hurt film made of new "Poly-Eth Hi-D" developed by Spencer Chemical Company.

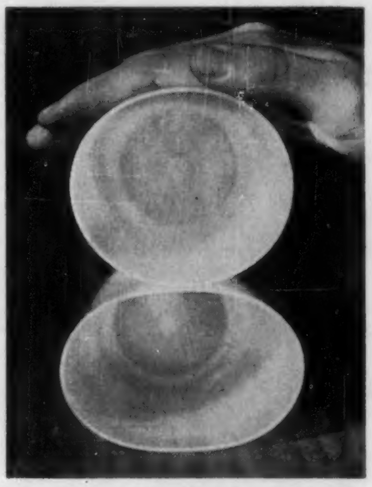
Remarkable new Hi-Density "Poly-Eth" by Spencer resists heat up to 240° F. It has the clarity and gloss of high pressure polyethylene, while approaching the rigidity of low pressure polyethylene

Food cooked in "see-through" packages is one of the countless new uses for polyethylene now possible because of Spencer Chemical Company's new high density polyethylene resin. Developed by Spencer's own staff, this new resin, trademarked "Poly-Eth Hi-D," has a density ranging from .935 to .940. It is non-toxic and odorless. Spencer is the first domestic producer to offer resins in this high density in commercial quantities.

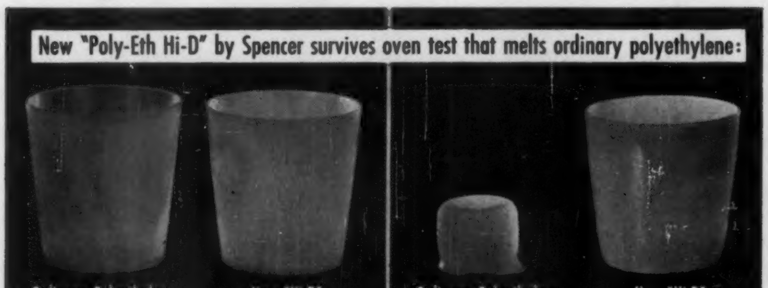
Among the unique properties of this new "Poly-Eth Hi-D" compared with standard or intermediate density polyethylene, here are a few of the most important: (1) Higher heat resistance —easily withstands boiling water without deformation; (2) Improved tensile strength and rigidity — permits in some cases, a money-saving reduction in wall thickness without loss in strength; (3) Less permeable.

Faster cycling periods are usually possible with "Poly-Eth Hi-D," since these resins can be taken from the mold at higher temperature. And products molded from "Poly-Eth Hi-D" will have improved resistance to surface abrasion.

Only Spencer offers you commercial quantities of this new polyethylene. So, for more information, contact your nearest Spencer sales representative, or write Spencer Chemical Company for a "Poly-Eth Hi-D" data sheet.



New "Poly-Eth Hi-D" (top) is stiffer than ordinary high pressure polyethylene (bottom cup). And notched Izod tests show it is tougher (resists impact better) than conventional low-pressure polyethylene.



(1) Before going into oven, these two polyethylene cups looked alike. Cup at left is made from standard polyethylene. Cup at right is Spencer Chemical Company's new high density polyethylene "Poly-Eth Hi-D."

(2) After 30 minutes at 240° F, the ordinary polyethylene cup has melted down; the "Hi-D" cup has retained its shape. This means you can use "Hi-D" for products subject to temperature of boiling water and higher.

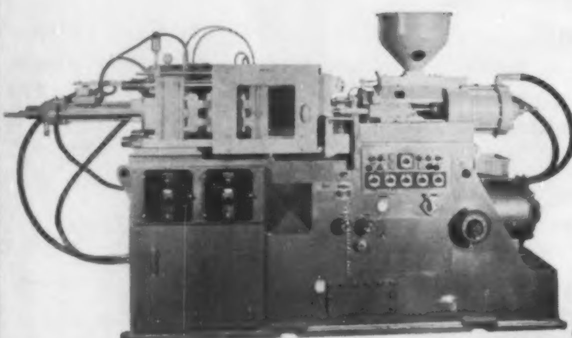
SPENCER CHEMICAL COMPANY
Dwight Bldg., Kansas City 5, Mo.

Here's why Fellows leads the way!

Here are the machines that lower your unit costs with higher speeds, more capacity...and true full-automatic operation: one operator can run three or more machines!

Sensitive, accurate controls simplify set-ups and change-overs as well as operation. Either the press or the injection assembly retracts for easy purging. Single control sets mold height and clamping adjustment. Stroke length adjustment on both press and injection ends. And many other features!

In plant after plant, more efficient *Fellows* machines set new standards of production...more pieces per hour, fewer rejects, less operator attention. Ask your Fellows Representative for the facts. And ask him about the Fellows Plan for deferred payment. Write, wire or phone any Fellows Office.



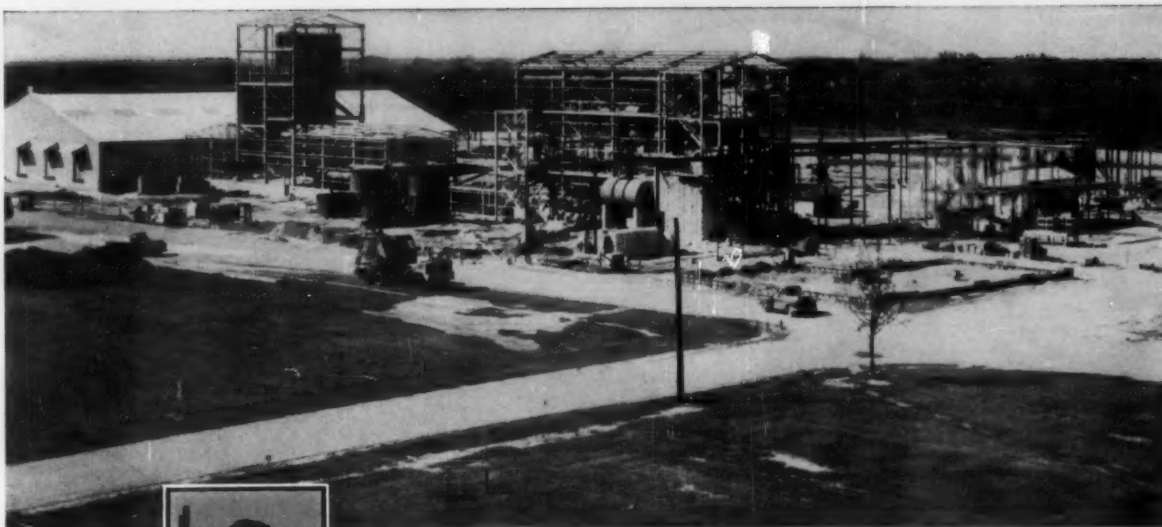
Fellows 3-125: fastest fully-automatic 3-ounce machine on the market! Dry run speeds from 600 to 840 cycles per hour, shots up to *4.5 ounces* with the optional pre-pack.

Fellows 6-200: fastest fully-automatic 6-ounce machine on the market! Dry run speeds from 490 to 650 cycles per hour, shots up to *9 ounces* with the optional pre-pack device.

Fellows

injection molding equipment

THE FELLOWS GEAR SHAPER COMPANY, Plastics Machine Division, Head Office and Export Department: Springfield, Vermont
Branch Offices: 319 Fisher Building, Detroit 2 • 150 West Pleasant Avenue, Maywood, N. J. • 5835 West North Avenue, Chicago 39
6214 West Manchester Avenue, Los Angeles 45



Polyvinyl Chloride Resin plant for Escambia Chemical Corporation designed and being built by Blaw-Knox

Latest addition to list of Blaw-Knox built RESIN plants

Shortly, Escambia Chemical's new 30 million pound Polyvinyl Chloride Resin Plant will go on stream . . . to join a long list of satisfied clients whom Blaw-Knox has served in the resins and plastics industry. The resultant experience and accumulated "know-how" is available to you.

Resin Clients served by Blaw-Knox

Installations for these companies suggest the extensive experience and broad background in design and erection of resin production facilities.

Abott Laboratories
Advance Paint Company
Amalgamated Chemical Company
American Cyanamid Company (3)
American Marietta Company
Apeles, Buenos Aires
Arco Paint Company
Armstrong Paint and Varnish Company
Aulcraft Paints, Ltd., Toronto
Barrett Division, Allied Chemical and Dye Corp. (2)
Bennett Paint and Glass Company
Brunswick-Balke-Collander Company
Bryant Electric Company
Bunge Y. Born, Buenos Aires
Canadian General Electric Company
Canadian Resins and Chemicals, Ltd.
Carbide and Carbon Chemicals Corp.
Carpenter-Morton Company
Catalin Corporation of America (2)
Chrysler Corporation
Continental Diamond-Fibre
Cook Paint and Varnish Company (2)
Crown Oil Company
Devoe and Raynolds Company (2)
Dow Chemical Company
Durez Plastics and Chemicals
Escambia Chemical Corporation
Falk and Company
Filtered Rosin Products Company
Firestone Tire and Rubber Company
General Electric Company (3)
Gilman Paint and Varnish Company
Glidden Company (2)
Goodyear Tire and Rubber Company (2)
Grand Rapids Varnish Corporation
Herbert Evans Company, Durban, South Africa
Hercules Powder Company
Hilton-Davis Company
Imperial Varnish & Color Company
Insular Chemical Corporation
Interchemical Corporation (2)
Irvington Varnish and Insulator Company
Jamestown Paint and Varnish Company
Libby-Owens-Ford Glass Company, Plaskon Division
Lilly Varnish Company
John Maff, Inc.
Marshall Eclipse Division, Bendix Aviation Corporation
Glenn L. Martin Company
McDougall-Butler Company
National Lead Company
National Starch Products, Inc.
Perkins Glue Company
Plywoods-Plastics Corporation
Pratt and Lambert, Inc. (2)
Raybestos Manhattan Inc.
Reliance Varnish Company
H. H. Robertson Company
Schenectady Varnish Company
Scholler Brothers
Scientific Oil Compounding Co.
Scott Paper Company (2)
Seidlitz Paint and Varnish Co.
Shell Chemical Corporation
Sherwin-Williams Company
F.A. Stresen-Reuter, Inc.
Stroock and Wittenburg (2)
Toronto Elevators, Ltd.
United Oil Manufacturing Co.
U.S. Industrial Chemical Co.
U.S. Rubber Company
Visco Products Company
Westinghouse Electric Corp. (2)

BLAW-KNOX COMPANY • Chemical Plants Division
Pittsburgh 22, Pa. • Chicago 1, Ill.
Designers, engineers and builders of plants for production of ALKYD RESINS
AMINO RESINS • EPON RESINS • OIL BODYING • PHENOL RESINS • SILICONE RESINS
SYNTHETIC RUBBER • VINYL POLYMERS AND COPOLYMERS • POLYESTERS

The Negri Bossi S-BR 1500 automatic vacuum former. Working surface 40" x 60".

The NEGRI BOSSI Vacuum Former with *"Movable-Focus"* Heating

There's an all new, patented heating unit built into this Negri Bossi automatic vacuum former.

Deriving heat from movable infrared rays, the **MOVABLE FOCUS** device directs heat to spots where it is needed most—permitting extremely deep draws and assuring constant cross-sections throughout the formed piece.

The system consists of a number of push-button controlled heat radiant sections, operated by independent cycles. It is possible to concentrate maximum heat in the working zone while diminishing heat in the rest zone as much as 50%.

And in a matter of seconds, sheets of various thicknesses and sizes can be adjusted with the Negri Bossi simplified hydraulic clamping device.

These vacuum forming developments are part of the Negri Bossi pattern of advanced, efficient plastics processing equipment.

Negri Bossi also manufactures an extensive line of laboratory type vacuum formers. And extra large units can be made on request.

Write for detailed information on machinery made by Negri Bossi.

Sole distributors:

U.S.A.—Acme Machinery & Manufacturing Co., Inc.
102 Grove Street, Worcester, Mass.
Phone: PLeasant 7-7747

New York Office: 2315 Broadway
Phone: SUsquehanna 7-1705

Canada-Plastic Equipment & Accessories
1362 Jean Talon Est.
Montreal 35, P. Q.
Phone: CRescent 4-8274

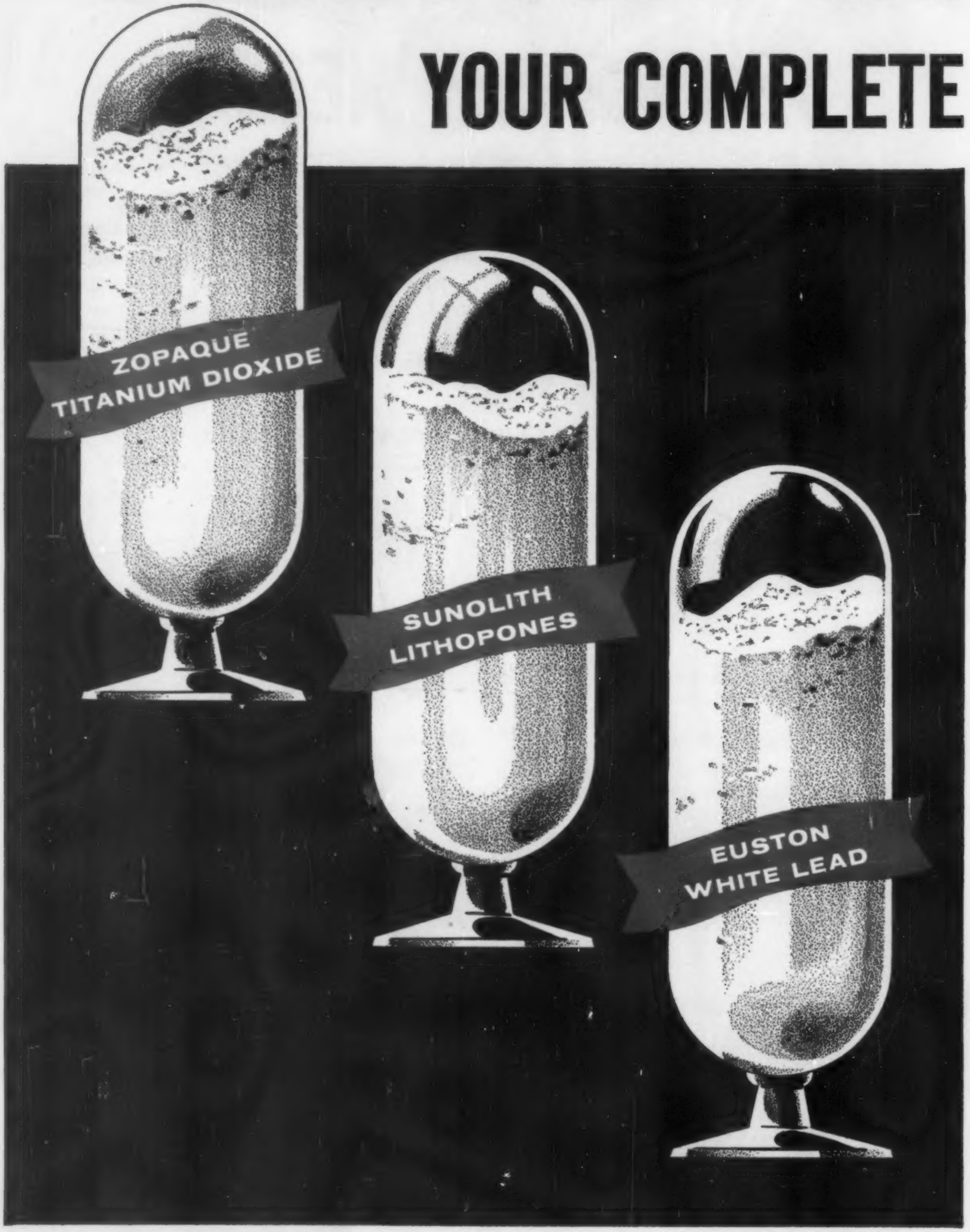
NB&C

NEGRI BOSSI & CO., MILANO (ITALY)

Corso Magenta, 44

Cable address: "Gianimar"

Glidden . . . now in
YOUR COMPLETE



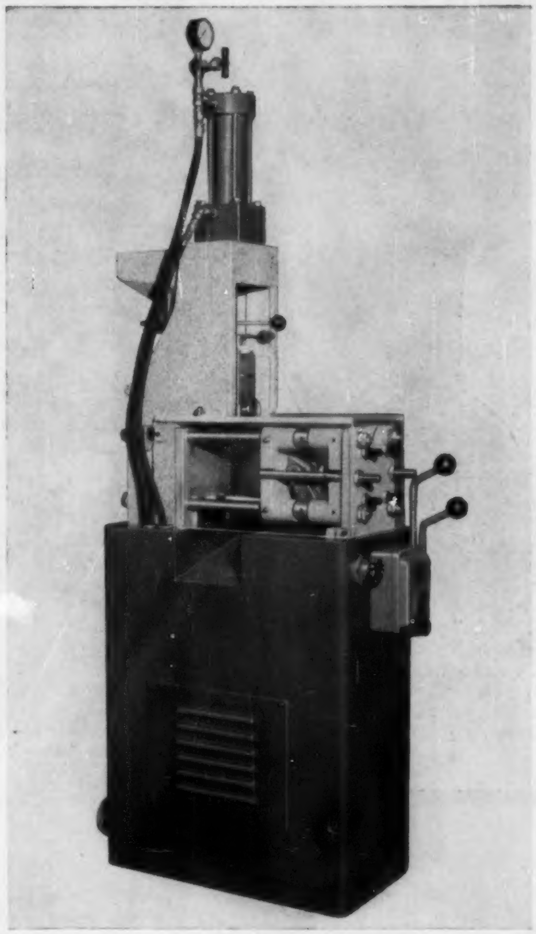
MINI-JECTOR

TRADE MARK

PLASTIC INJECTION MOLDING MACHINES

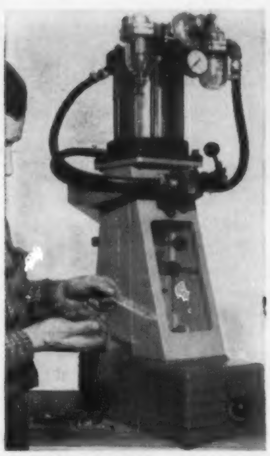
THERE IS A MINI-JECTOR MADE TO SOLVE YOUR SMALL CAPACITY (1/3 oz. to 1 oz.) INJECTION MOLDING PROBLEMS

Here are the small thermoplastic injection molding machines that do a small job in a big way! Economical to operate and low in cost, these up to 1 ounce plastic injection molding machines are turning out thousands of small plastic items every day for hundreds of satisfied users. Molds any thermoplastic . . . including Nylon. The Mini-Jectors are the most versatile machines in their class. Simple and compact in design, Mini-Jectors operate easily and efficiently and owners everywhere find they pay for themselves many times over.

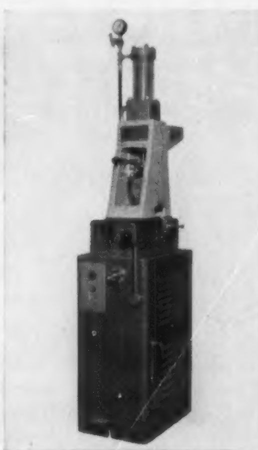


MODEL 60-PC 75 "HORNET" POWER OPERATED LEVER CONTROLLED. Mold size 6" x 5" x $5\frac{1}{8}$"

This model retains all of the time-tested features of our popular 60-HC75 with the added feature of hydraulically operated, lever controlled mold opening and closing for faster, easier production. Like all Mini-Jectors the 60-PC75 gives you the most economical way of injection molding articles in the capacity range of $\frac{1}{3}$ oz. to 1 oz., where modest scale production is required.



MODEL 45 "WASP" $\frac{3}{4}$ oz. capacity air-operated Mini-Jector . . . fast and economical. 6" air cylinder operates ram . . . 40 to 150 pounds of air pressure required depending on type of plastic used and product being molded. Material hopper capacity 4 pounds.



MODEL 50 "WASP" a new Mini-Jector . . . capacity 1/3 oz. to 1 OUNCE at pressures up to 30,000 PSI. This is an ideal model for precision insert work with any type of plastic. Hydraulically operated.

EVERY DAY THOUSANDS OF ITEMS ARE BEING PRODUCED PROFITABLY ON MINI-JECTORS

WRITE TODAY . . . for literature telling how Mini-Jector may help solve your injection molding problems, to . . .

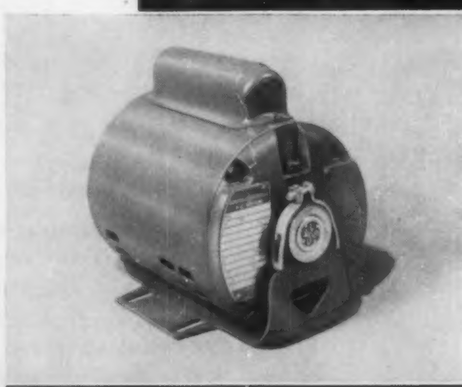
NEWBURY INDUSTRIES, Route 87, Newbury, Ohio

"Specializing in the Production and Development of Plastic Injection Molding Machines up to one ounce capacity."

Here's how Du Pont MYLAR® is helping

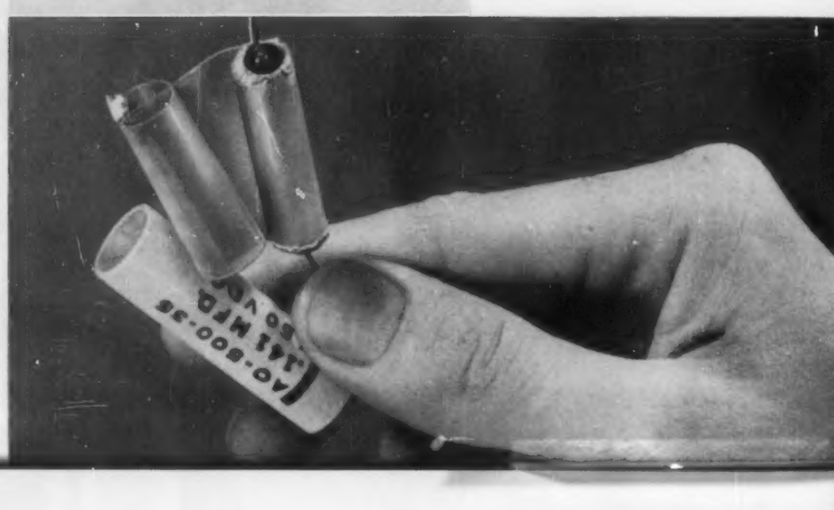
TEXTILES. "Mylar" polyester film is used as the base for an improved type of metallic yarn. It provides extra strength for weaving or knitting . . . resists normal textile chemicals used in dyeing. "Mylar" is opening new markets for manufacturers of finished garments by removing past restrictions on metallics in fabrics such as wools and cottons.

DECORATIVE SURFACING.—Used as a surfacing material, "Mylar" adds beauty and long lasting luster to a wide range of consumer products. Flexible "Mylar" can be metalized. It can also

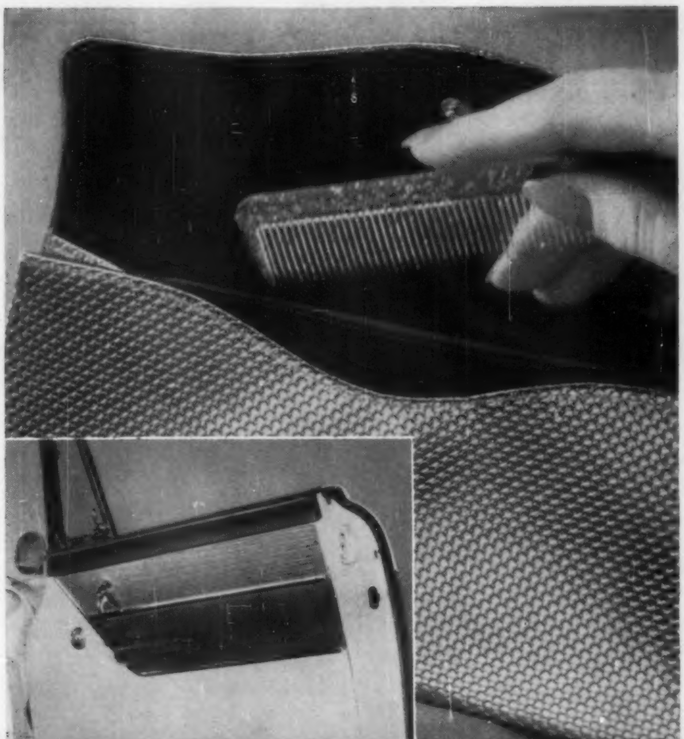


ELECTRICAL. "Mylar" is ideal for use as an insulating material in electrical-electronic equipment. It combines high dielectric and physical strength with resistance to chemicals and moisture. Thinner gauges of "Mylar" are helping manufacturers reduce size, weight and costs in products such as motors, transformers, coils and capacitors.

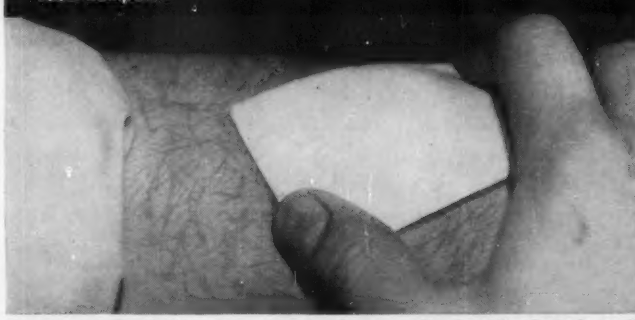
PACKAGING. "Mylar" is a tough film for tough packaging jobs. With "Mylar", heavy, bulky and irregularly shaped objects, such as blankets, toys or hardware items, can now capitalize on the impulse value of transparent packaging.



industry improve product performance



be laminated and embossed to create glamorous, scuff resistant non-tarnishing material for ladies' accessories, automobile panels and bathroom hampers.



MEDICAL. For the first time, surgeons have an absorbent bandage that will not adhere to the skin. Non-toxic perforated "Mylar" is placed over the wound, permitting fluids to flow into the cotton to which the "Mylar" is laminated.

RECORDING TAPES. Tapes with "Mylar" are used in recording sound and now video. These tapes are thinner, yet stronger, and *are* unaffected by changes in temperature and humidity as demonstrated in "tape torture test" above.

CAN I USE "MYLAR" IN MY PRODUCT?

Whether you make ladies' lingerie or guided missiles, there may be a way to add value to your product . . . to make it more profitable . . . by using Du Pont "Mylar"*. This remarkable polyester film has a balance of properties never before available in a plastic material. For more information on applications, properties and types of "Mylar" available, send in the coupon below. Be sure you indicate the specific application you have in mind.

**"Mylar" is Du Pont's reg. trademark for its brand of polyester film.*

Names of firms who manufacture the products pictured here available on request.

In Canada, "Mylar" is sold by Du Pont Company of Canada Limited, P.O. Box 660, Montreal, Quebec.

DU PONT

REG. U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING

. . . THROUGH CHEMISTRY

DU PONT

MYLAR®

POLYESTER FILM

E. I. du Pont de Nemours & Co. (Inc.)
Film Dept., Room M-12, Nemours Bldg.
Wilmington 98, Delaware

Please send your booklet on properties, applications and types of "Mylar" polyester film available (MB-4).

I am interested in "Mylar" for__________

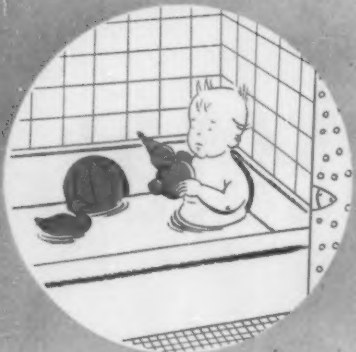
Name__________

Firm__________

Address__________

City__________State__________


Save time, money, storage space with—
DE MATTIA GRANULATORS
PROCESS ALL YOUR SCRAP
With De Mattia Scrap Grinders in your molding shop you can reclaim all your scrap — large chunks from heating cylinders, accumulations from nozzles and real tough molded pieces — in your own plant, at once. Models for press-side installation save handling and make salvaged material immediately available. There is a De Mattia model for every scrap processing need.
GRANULATOR No. 1
Simple, rugged and highly efficient. Has capacity of 200 lbs. per hour. 3 H.P. Motor with double V belt and Meehanite flywheel. Features high grade roller bearings with positive seal. Four cutting blades placed on a bias permit efficient cutting of thin strips in Vinyl, Saran, etc. Standard screen with 1/4" openings (other screen sizes on request). Hopper opening 13 1/4" x 4 1/2". Floor space required 32" x 44"; net weight with motor (approx.) 800 lbs.
GRANULATOR No. 3
For low-cost salvage of the large slugs and chunks resulting from cleaning out the heating cylinder, accumulation at the nozzle and also those molded pieces too tough for the average sprue and scrap grinder. Capacity — Over 150 lbs. per hr. 3 H.P. Motor in Base. Double V Belt Drive. Heat treated Alloy Steel Rotor High Grade Roller Bearings with Positive Seals. Standard Screens with 11/32" Openings (other sizes on order). Hopper opening 9" x 4 1/4".
GRANULATOR No. 4-A
Recommended for at-the-machine operation. Capacity 75 lbs. per hour; 2 H.P. Motor 1200 RPM; Direct drive; Solid semi-steel hopper; High grade roller bearings with positive seals; Standard screen with 11/32" opening (other sizes on order). Hopper opening 9" x 4 1/4". Overall dimensions 39" long, 18" wide, 42" high. Net weight 500 lbs. with base.
DE MATTIA MACHINE and TOOL CO
DE MATTIA MACHINE and TOOL CO.
CLIFTON • NEW JERSEY



Baby Playthings

Toddler Toys

Housewares

Modern House Fittings

Outdoor Living Aids

Containers & Packaging

Symbols of your potential through Tupper Corporation

Premiums

● Whatever your custom needs in plastics manufacturing, call on Tupper's wide experience and modern manufacturing facilities. Our large, up-to-date plants, equipped with the best production machinery, are available for materials, injection molding, extruding, vacuum forming, blow molding—and other advanced processes.

The Tupper Engineering Department has developed the greatest number of patents in the industry for polyethylene seals, closures, and dispensers—and other items in other plastics. This know-how can be tapped by you to place your plastic products in a position of leadership.

Tupper seals and other Tupper products are protected against unauthorized manufacture by about 150 U. S. and foreign patents and patents applied for, plus numerous trademarks and copyrights.

Do-It-Yourself Materials

TUPPER! Trade-mark

TUPPER CORPORATION

Manufacturers of: CONSUMER, INDUSTRIAL, PACKAGING and SCIENTIFIC PROD''CTS
Factories, Laboratories and Sales Offices:
Massachusetts, Rhode Island, Florida, Montreal, New York
Address correspondence to:

Dept. M-12 Tupper Corporation Woonsocket, R. I.	or	Dept. M-12 Tupper Corporation 225 Fifth Ave., N.Y.C.

Oronite*

ISOPHTHALIC

advanced raw material for plasticizers and plastic products

You can discover in your own laboratory that Isophthalic plasticizers offer greater thermal and color stability, greater plasticizing efficiency, lower volatility, lower toxicity and less odor.

Isophthalic is a new low-cost raw material for polyesters, polyamides and polyester amides. It's the lowest cost diabasic acid that forms the full molecular weight range of linear and cross-linked polymers.

Investigate Isophthalic for injection molding compounds, polyurethane foams and new adhesives—or wherever high thermal and chemical stability are important.

Contact the Oronite office nearest you for complete information.

ORONITE CHEMICAL COMPANY

EXECUTIVE OFFICES
200 Bush Street, San Francisco 20, California

SALES OFFICES
30 Rockefeller Plaza, New York 20, New York
20 North Wacker Drive, Chicago 6, Illinois
Mercantile Securities Building, Dallas 1, Texas
Carew Tower, Cincinnati 2, Ohio
714 W. Olympic Blvd., Los Angeles 15, Calif.
450 Mission Street, San Francisco 5, California

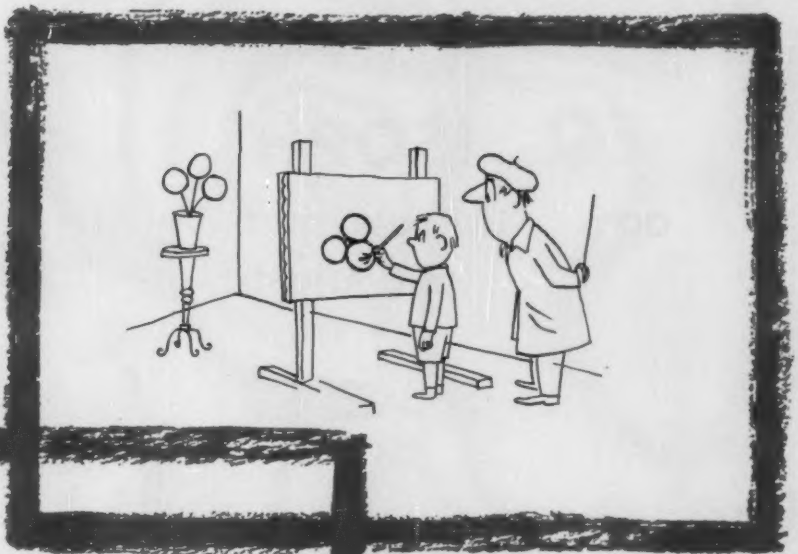
EUROPEAN OFFICE
36, Avenue William-Favre, Geneva, Switzerland

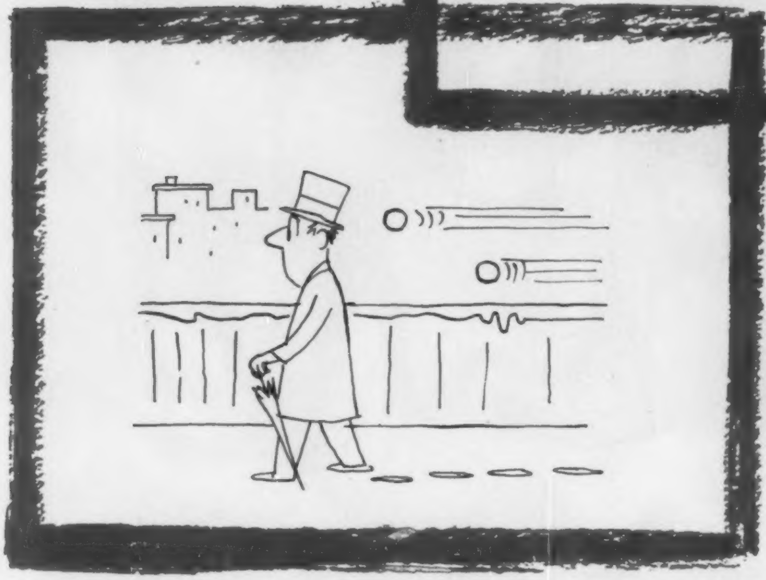
ORONITE CHEMICAL COMPANY

*T.M.

FROM

Design





TO

Delivery

LOOK TO WATERTOWN

Plastics is our business . . . therefore, we can offer help anywhere along the line from idea to delivery.

Our advanced designing, experienced engineering, modern laboratory staffed by expert technicians, and precision production are your assurance of custom molding to meet your most exacting specifications. Compression, injection, transfer molding, and vacuum forming. All thermoplastic and thermosetting materials.

Any size or shape. And at a price you'll like. For information or quotation, write to . . .

THE WATERTOWN MANUFACTURING CO.

1000 ECHO LAKE ROAD, WATERTOWN, CONN.


available in standard and custom engineered models
for trimming and piercing vacuum-formed plastics
DAKE HYDRAULIC PRESSES
for molding reinforced plastics
Be a pacemaker in the fast-moving plastics industry with equipment designed to keep production geared to modern trends. Dake Hydraulic Presses speed output and reduce costs. They are job-engineered by men experienced in the plastics industry. These men are ready to help you meet special requirements as well as provide better equipment . . . both for compression molding of reinforced plastics as well as trimming and piercing vacuum-formed plastics. Standard models are electric-hydraulic in operation, with capacities ranging from 25 to 300 tons. They are adjustable for stroke, pressure, temperature and timing. Dual palm-operated controls are standard, providing safety in operation. Dake will gladly work with you in developing whatever special press equipment you need.
For descriptive literature on these presses, write for Bulletins 340 and 352.
DAKE CORPORATION 648 Monroe Street, Grand Haven, Michigan
DAKE PRESSES
Arbor Presses
Hand-Operated Hydraulic
Power-Operated Hydraulic
Guided Platen
Gap Type Presses
Movable Frame

tobacco
and many others

☐ ask a technical representative to call.

ADDRESS

NEW! Colorful Plastainer Jars BY OWENS-ILLINOIS

Owens-Illinois packaging know-how and high-quality standards offer you the *finest* in plastic molding facilities . . . Injection molding . . . Compression molding . . . A complete range in plastics for packaging, for specialties.

Branch Offices:

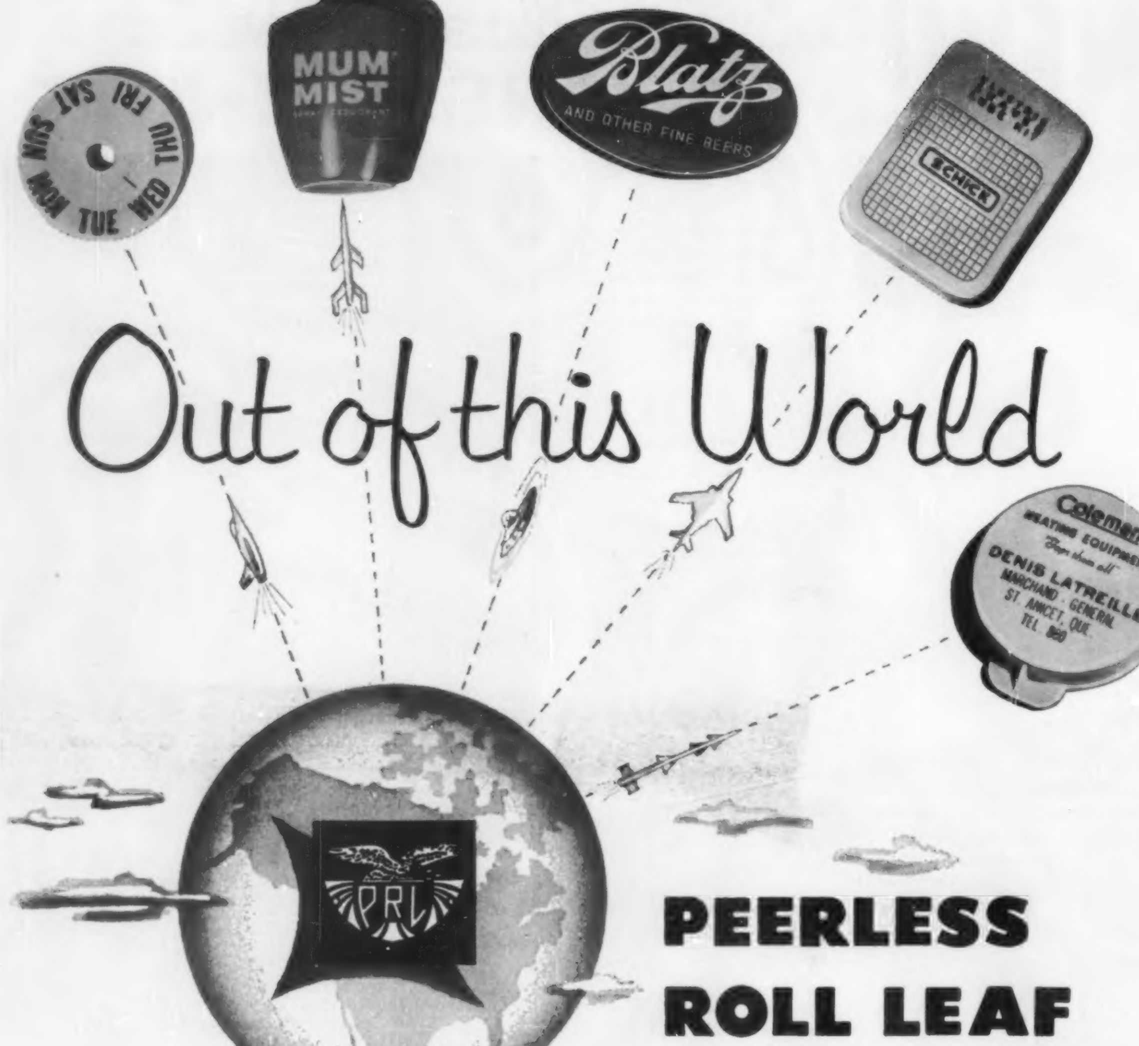
Albany	New York	Dallas	Texas	Milwaukee	Wisconsin	Richmond	Virginia
Atlanta	Georgia	Denver	Colorado	Nashville	Tennessee	Rochester	New York
Baltimore	Maryland	Detroit	Michigan	New Orleans	Louisiana	Sacramento	California
Birmingham	Alabama	Fresno	California	New York	New York	St. Louis	Missouri
Boston	Massachusetts	Hartford	Connecticut	Oakland	California	St. Paul	Minnesota
Buffalo	New York	Houston	Texas	Oklahoma City	Oklahoma	Salt Lake City	Utah
Charleston	West Virginia	Indianapolis	Indiana	Omaha	Nebraska	San Francisco	California
Charlotte	North Carolina	Jacksonville	Florida	Peoria	Illinois	Seattle	Washington
Chicago	Illinois	Kansas City	Missouri	Philadelphia	Pennsylvania	Toledo	Ohio
Cincinnati	Ohio	Los Angeles	California	Pittsburgh	Pennsylvania	Yakima	Washington
Cleveland	Ohio	Louisville	Kentucky	Portland	Oregon		
Columbus	Ohio	Memphis	Tennessee				

Pacific Coast Headquarters, 350 Sansome St., San Francisco . . . Plants at San Jose, Calif.; St. Charles, Ill.; Glassboro, N. J., and Riverdale, N. J.

OWENS-ILLINOIS PLASTICS
AN (I) PRODUCT

OWENS-ILLINOIS
GENERAL OFFICES · TOLEDO 1, OHIO

Out of this World



PEERLESS ROLL LEAF

for Plastics Marking

You too, will discover that the PEERLESS process of marking plastics is out-of-this-world. Practical, and yet inexpensive, is the PEERLESS method of trade-marking, identifying, and decorating parts and products made of plastics, paper, wood, fibre, leather, fabrics, etc. Engraved and embossed effects at high printing speeds . . . wide range of colors, including gold and silver. Stamping presses to meet every need . . . hand, electric motor, compressed air . . . semi to fully automatic feed and delivery. A PEERLESS Roll Leaf "label" does not wear or rub off, because it is engraved into the surface of the material, forming a permanent, integral part of the product. If you want proof of this "out-of-this-world" PEERLESS process of plastics marking, write or phone for samples or ideas.

Achievement toward Perfection

PEERLESS ROLL LEAF COMPANY, INC.

4511 - 4515 New York Ave., • Union City, N. J.

BRANCH OFFICES: BOSTON • CHICAGO • *Peerless Roll Leaf Division* • GANE BROS. & LANE, INC.
REPRESENTATIVES: ST. LOUIS • LOS ANGELES • SAN FRANCISCO • LOUISVILLE • MONTREAL • LONDON, ENG.

TECHNICAL BULLETIN

CLAREMONT
RESEARCH
DIVISION

date: DEC. 1, 1956
subject.

COMPLETE INK SERVICE FOR PRINTING ON POLYETHYLENE

Full range of colors and metallics—clear, brilliant dependable inks that really work!

Prints by HARTFORD TEXTILE CORP.

Stock formulations for valley and gravure printing on treated and untreated film, and formulations for special applications available on request.

The Polyethylene ink series can be handled on conventional equipment with conventional thinners.

Ask for our Technical bulletin on the "RP" gravure series and the "MB" valley series for Polyethylene Printing.

TROUBLE FREE COLOR UNIFORMITY FOR EXTRUDED AND CALENDERED POLYETHYLENE

The "PE" series granular concentrated colorants

Complete technical information on printing and coloring vinyl available on request

Claremont is an information and service center on plastic coloring and printing problems. Our engineering suggestion and advice are always yours for the asking.

Request Technical bulletin #220 which offers full data to aid fabricators in producing colored polyethylene products, presents test results and ratings on heat and light stability, migration and crocking, alkali resistance, relative strength, suggestions and recommendations on uses and formulations.

In all Claremont products, *calibrated* color uniformity is guaranteed. You are assured of absolute maintenance of specified hues batch after batch.

"28 Thermex® Plastic Preheaters help us keep up a 'round-the-clock pace" *says Roy Gill, Foreman, Allen-Bradley Co.*

• Allen-Bradley Company, Milwaukee, pioneer manufacturer of top-quality motor controls, makes more than 2000 different plastic parts for its products. Its molding department has used THERMEX Electronic Preheaters since 1946 and now has 28 units which work with each press on automatically controlled time cycle.

Roy Gill, Foreman, says this about their performance: "Our molding department works three shifts. We have found THERMEX Preheaters highly satisfactory not only for uniform, high-quality molding, but for their dependable operation 24 hours a day. These rugged units help us minimize production time losses and maintenance expenses."

Find out how you can improve *your* molding operations with THERMEX Plastic Preheaters. Call or write The Girdler Company, Thermex Division, Louisville 1, Kentucky.

*THERMEX—Trade-Mark Reg. U. S. Pat. Off.

This 3 KW THERMEX Unit heats preforms to 280°F in 30 seconds for molding relay bases—12 at a time. Complete preheating and molding cycle is 2.4 minutes.

The GIRDLER Company

A DIVISION OF NATIONAL CYLINDER GAS COMPANY
Louisville 1, Kentucky
THERMEX DIVISION

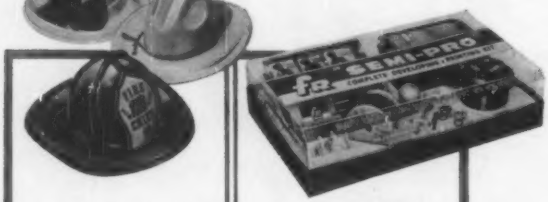
Sales Offices: 76 Beaver St., New York 5, N. Y. • 133 So. Clinton Ave., Rochester 4, N. Y. • 505 Delaware Ave., Buffalo 2, N. Y. 239 Newton Ave., Newark, Ohio • 624 So. Michigan Ave., Chicago 23, Illinois • 714 West Olympic Blvd., Los Angeles, Calif.

CLAREMONT *pigment dispersion corp.* ■ *39 powerhouse road, roslyn heights, l. i.*

Joseph Davis Plastics

ACETATE
Hi-impact Styrene
SHEETS
FILM
Rods and Tubes

Transparent, translucent, opaque . .
light-to-heavy gauges..cut and slit-to-size
suitable for **VACUUM FORMING**



Party hats vacuum formed of flame retardent JODA ACETATE in 6 brilliant colors by

FANCHON CO.
New York City

Cover for photography kit manufactured from clear transparent JODA ACETATE

ACETATE BOX CORP.
Brooklyn, N. Y.

JODA EXTRUDED CELLULOSE ACETATE SHEETS, ROLLS AND FILM declared to be best quality on the market . . . the result of a survey conducted by one of the largest chemical manufacturers in America.

Sales Representatives Conveniently Located

JOSEPH DAVIS PLASTICS COMPANY

Phone KEarny 2-0980-0981 JODA U.S.A. N. Y. BArclay 7-6421-2

430 Schuyler Ave., Arlington, N. J.


color-full rez-n-dye

General Electric is just one of the many users of Radialloy-Tipped* Circular Saw Blades

Illustrated is a General Electric class being taught Textolite* plastics fabricating with a Radialloy-Tipped* Circular Saw Blade.

Whatever your "tough sawing" problem may be, there's a Radialloy-Tipped* Circular Saw Blade available to do the job better, quicker, far more economically.

Write for prices and brochure on our complete line.

Manufacturers Representatives:
Some Select Areas Still Open. Write.

Radialloy-tipped
SAWS & CUTTERS

RADIAL CUTTER MANUFACTURING CORPORATION

829 Bond St., Elizabeth 4, New Jersey

SPECIALISTS AND LEADING MANUFACTURER OF CARBIDE-TIPPED SAW BLADES

*Reg. U. S. Pat. Off.

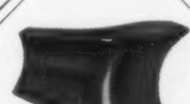
ERIEFLEX® REFLECTOR LENSES SHOUT

STOP

on the 1957 **FORD**

SOME OTHER TAILLIGHTS and BACK-UP LENSES PRODUCED BY

ERIE plastics



1957 MERCURY TAILLIGHT

1956 MERCURY ERIEFLEX TAILLIGHT

1956 FORD ERIEFLEX TAILLIGHT

ERIEFLEX Reflector Lenses have optical precision. They combine the superior brilliance of custom injection molded acrylic with special prismatic design. Their jewel-like sharpness reflects light over a greater distance and width of range.

ERIEFLEX Reflector Lenses exceed S.A.E. and state automotive requirements.

ERIEFLEX Reflector Lenses have a superior color stability . . . deliver higher candle power . . . are practically unbreakable in shipment, handling, and assembly . . . have dimensional accuracy and flexibility for quick, easy assembly.

ERIE Sales Engineering Department is available to give you technical assistance in solving your reflector lens and taillight problems.

TRADE ERIE MARK plastics

ERIE PLASTICS DIVISION

ERIE RESISTOR CORPORATION

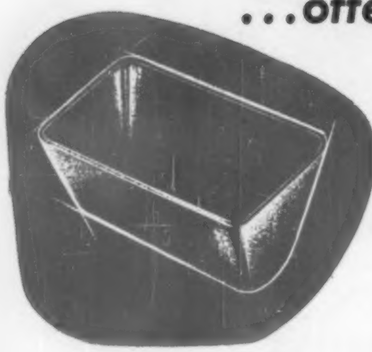
Main Offices and Factories: **ERIE, PA.**

Manufacturing Subsidiaries

HOLLY SPRINGS, MISSISSIPPI • LONDON, ENGLAND • TRENTON, ONTARIO

A DEVELOPMENT OF INTEREST TO YOU IN REINFORCED MOLDING COMPOUNDS

...offers expanded opportunities for—



- redesigning multiple metal parts into a single plastic piece
- making unusually large molded pieces
- producing complex shapes with deep draw and intricate detail
- obtaining exceptional impact strength, corrosion resistance and electrical properties

NOW...THERMAFLOW AND ATLAS JOIN RESOURCES

...to open new possibilities in reinforced molding compounds. This move brings together the plastics molding experience of Thermaflow, leading supplier of reinforced molding compounds, with the broad research facilities of Atlas, leading developer of special organic chemicals.

Through this association, designers and molders will get even better service on present types of Thermaflow glass fiber reinforced and nylon rag reinforced compounds for high impact, corrosion resistant and other demanding requirements. And they can look forward to new and improved materials which will offer interesting ways to obtain superior product performance, design simplification and production economy. Send for literature file.

THERMAFLOW

CHEMICAL CORPORATION

Atlas Building, Wilmington 99, Delaware

a subsidiary of

ATLAS POWDER CO.

Wilmington 99, Delaware

In PLASTICS, the plant that does everything!

THESE PRODUCTS:

GERING "the Hose with the Mirror Finish."

GERLITE Extruded Acrylic Sheets, clear or colored, to 54" wide, to .125" thick, any practical length. For Illuminating Signs, Lighting Fixtures and Vacuum Forming Applications.

GER-FLEX Vinyl Tubing

GER-TUBE Polyethylene Tubing from 1/32" to 4" I.D., also special shapes and cross-sections.

DRYCOL on-the-spot, in-plant colorant for all thermoplastics.

S-T-R-E-T-C-H Polyethylene master-batch color concentrate.

STYROMIX Clear polystyrene dry-blended with color and lubricants, ready to mold.

GER-PAK Polyethylene film, sheeting, and tubing for packaging consumer and industrial products. Moisture-vapor barrier up to 20 feet wide, for use in light and heavy construction.

THESE SERVICES:

Molding Powders Division

We manufacture for standard and special applications, for injection and extrusion molding:
Polystyrene • Vinyls • Polyethylene Cellulose Acetate • Ethyl Cellulose Acrylic • Nylon

Extruded Products Division

Complete Department equipped with extruders from 2" to 10" with dies and take-off equipment to make Sheeting, Tubing, Rods, Pipe, Special Cross Sections and Shapes.

Custom Compounding

Complete facilities for top quality processing. Full staff of laboratory, technical and engineering personnel.
Polyethylene • Vinyls • Nylon • Acrylic • Cellulose Acetate • Butyrate Ethyl Cellulose • Polystyrene and its Copolymers

SCRAP RECLAMATION

Far ahead of any ordinary scrap reclamation is the job done at Gering. Our long experience coupled with skilled technical personnel enables us to work wonders with scrap sorting, separating, grading, decontaminating, blending, color matching, compounding, and pelletizing.

GERING

PRODUCTS, INC.

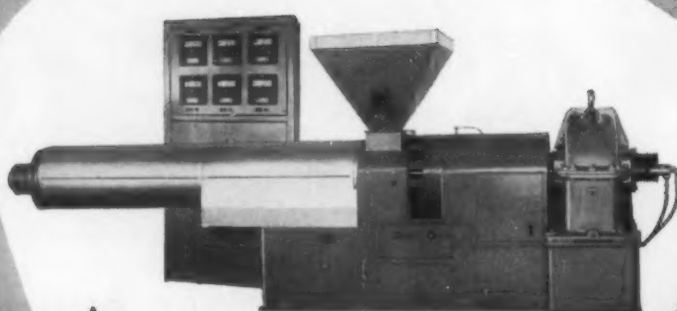
KENILWORTH, N. J.

Service • Quality • Dependability

Pioneers in modern plastics for over 30 years!

extruders by *Egan*

From 2" Thru 8" with screw lengths of 16 or 20 Diameters. • Hard corrosion resistant liners. • Heavy duty thrust and radial bearings with force feed lubrication. • Completely prewired temperature control cabinet. • Screw speed tachometer. • Precision ground screws. • Large feed hopper with sight glass and cut-off slide. Complete installations for film, sheet, pipe, shapes.



THE EGAN 8" EXTRUDER

Delivery From 3 Weeks

Our new plant in Somerville, N. J. with increased facilities enables us to offer prompt delivery on most sizes of extruders.

Write or Phone Today For Complete Information—No Obligation.

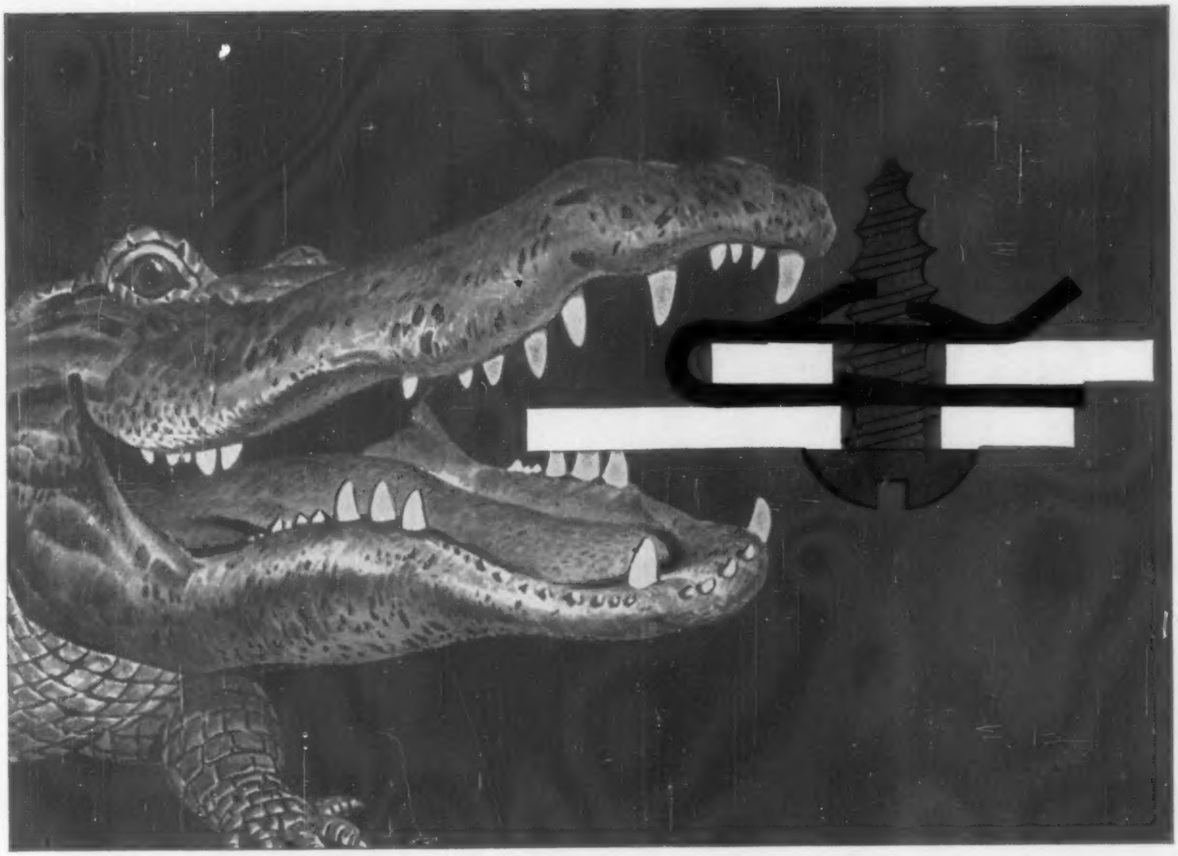
FRANK W. EGAN & COMPANY, Somerville, New Jersey

Designers and Builders of Machinery for the Paper Converting and Plastics Industries

Cable Address: "EGANCO"— Somerville, Nier.

Representatives: WEST COAST — John V. Roslund, 244 Pacific Bldg., Portland, Ore. MEXICO, D. F. — M. H. Gottfried, Avenida 16 De Septiembre, No. 10.
Licensees: GREAT BRITAIN — Bone Bros. Ltd., Wembley, Middlesex. FRANCE — Achard-Picard, Remy & Cie, 36 Rue d'Enghien Xe, Paris. ITALY — Emanuel & Ing. Leo Campagnano, Via Borromei I B/7, Milano. GERMANY — ER-WE-PA, Erkrath, bei Dusseldorf.


Laminate performance starts
with fabrics that perform
... let your laminating job pick
the fabric at Wellington Sears!
You don't really know what fabric you'll need until all the job specifications are in. Such factors as impact strength, shock resistance, bonding strength, and others have to be considered as part of the total picture of the laminate. But regardless of the specifications, and regardless of the fabric finally chosen, it's important to know that your choice is virtually unrestricted—that at one source you can get the specific fabric the job calls for. Quality cotton drills, duck, spun nylon, filament nylon, Orlon*, Dacron**, and other synthetics, and Lantuck non-woven fabrics—all specifically engineered for laminating, all available at Wellington Sears. Another important factor: Wellington Sears experience. Over a century of providing fabrics to industry is behind the Wellingon Sears line. This experience works with yours, in insuring superior performance for both high and low-pressure laminating—for coating and all plastics operations involving fabrics. For informative, illustrated booklet, write Dept. K12.
*DuPont's acrylic fiber **DuPont's polyester fiber
Wellington Sears
FIRST In Fabrics For Industry
For Coated Materials, High and Low Pressure
Laminates and Other Reinforced Plastic Products
WEST POINT
WP
TEXTILES
Wellington Sears Co., 65 Worth St., New York 13, N. Y. • Atlanta • Boston • Chicago • Dallas • Detroit • Los Angeles • Philadelphia • San Francisco • St. Louis



STEEL JAWS THAT NEVER RELAX
fasten a fastener in place

Alligator jaws have nothing on Tinnerman "U" and "J" type fasteners in gripping power. These fasteners press easily into locked-on position over panel edge or center panel locations. Yet they provide positive self-retention, ending the need for welding, staking or other secondary fastening devices. They are ideally suited for blind assembly or hard-to-reach locations.

When combined with the familiar Tinnerman Speed Nut, this unique fastening principle provides a one-piece, self-locking, self-retaining fastener that is fast and easy to apply. The "U" or "J" feature can be combined with wire and tube retainers, latches, catches and a host of other fastening requirements to save time, material and production costs.

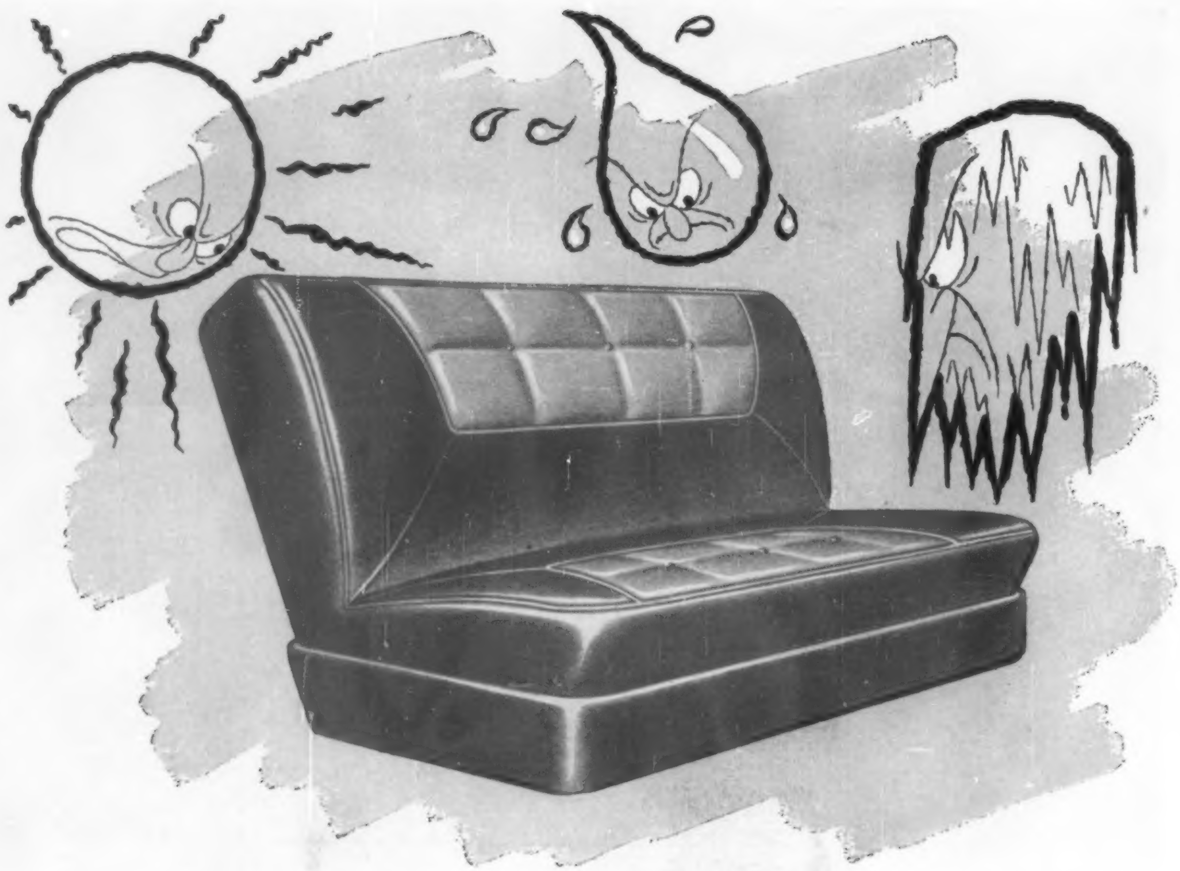
Find out about these and more than 8,000 other types of Speed Nut brand fasteners now serving industry all around the world. They can make important savings for you, can also simplify your assemblies. See your Tinnerman representative soon or write to us. **Tinnerman Products, Inc., Box 6688, Dept. 12, Cleveland 1, Ohio.**

TINNERMAN
Speed Nuts®
FASTEST THING IN FASTENINGS®

Greater flexibility for control equipment enclosures is provided by self-retaining "J" type Speed Nuts at 30% less production cost.

Assembly costs on this sheet-metal skylight frame are reduced 66% by Tinnerman "U" type Speed Nuts.

Gas range assembly costs are reduced 25% to 50% by using Tinnerman "U" and "J" type Speed Nuts.



PLASTOLEIN® 9058 DOZ meets the tough requirements of Automotive Upholstery...

Most manufacturers of automotive vinyl fabrics use Plastolein 9058 to give them low temperature performance required by the conditions of use in automobiles, trucks, buses, trains, and other transportation vehicles. Not only does Plastolein 9058 impart low temperature flexibility but it provides good overall extraction, volatility and stability properties.

If your product must meet tough conditions of use that involve low temp. flex., whether it be automotive fabrics, outdoor upholstery, outerwear, rainwear or a host of others, Plastolein 9058 DOZ or 9057 DIOZ assures you the biggest available safety factor against stiffening and failure.

For the complete details on Plastolein 9058 DOZ and all other Emery plasticizers, mail coupon below.

Emery

Organic Chemical Sales Department

Emery Industries, Inc., Carew Tower, Cincinnati 2, Ohio

EMERY INDUSTRIES, INC.
DEPT. F12, CAREW TOWER
CINCINNATI 2, OHIO

Please mail copy of 32-page EMERYFACTS titled "Plastolein Plasticizers"

Name.................................Title............

Company..

Address...

City...................................State............

MODERN PLASTICS

Volume 34
December
1956
Number 4

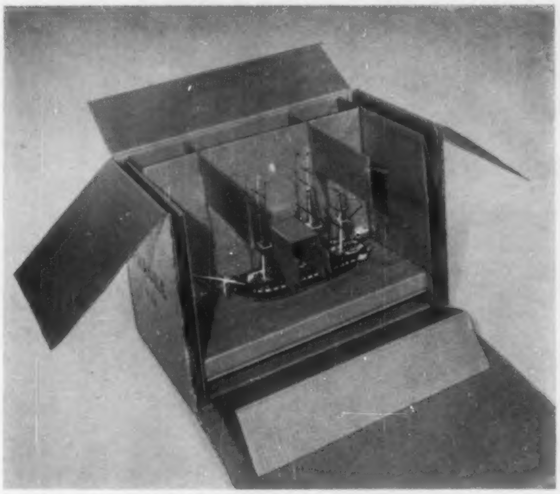


Fig. 1: Revell plastic model of U.S.S. *Constitution* is shipped in corrugated container; partitions and inserts are used to cradle craft securely. (Photo, Robert Gair Co., Inc.)

Each item is a special problem in Packaging plastics products

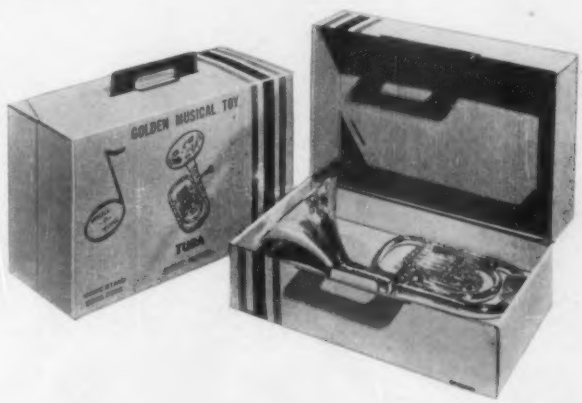


Fig. 2: Proll plastic tuba is sold in corrugated box in which die-cut platform anchors instrument in place. Integral handle makes box a carrying case. (Photo, Hinde & Dauch)

Making a good plastic product or component is one thing. *Delivering* it intact and unmarred is another. This means that the plastics product manufacturer must be prepared to do a good job of packaging. Particularly in view of the high cost of labor and materials and the intensity of today's competition, he cannot afford to overlook the importance of adequate packaging in maintaining a profitable business operation.

Despite continuing efforts by industry to cut losses to a minimum, damage to goods in shipment still runs more than $100 million annually (not for plastics items alone, but for all types of merchandise). Most of this damage, shipping authorities agree, is traceable to careless or faulty packing and shipping methods. And aside from actual damage claims, the shipper may unknowingly be paying out huge sums through the use of uneconomical packaging methods.

As pointed out by Monsanto Chemical Co., Plastics Div., in an informative brochure on packing and shipping plastics, "the current trend in the plastics industry is unquestionably toward shipments of merchandise in larger-unit quantities. This practice can produce some

Fig. 3: Card-mounted cellophane tape dispenser molded of styrene is enclosed by formed acetate bubble that keeps dust out while providing full product visibility

Fig. 4: Transparent acetate collars and printed cardboard labels are combined into package for Con-Tact adhesive-backed vinyl tape, affording full protection

Fig. 5: Rolls of Con-Tact film in printed polyethylene bags are sold at the retail level directly from the corrugated self-shipper display stand

special gains for suppliers of plastic end-products. When guided by proper stacking and loading methods, it can reduce damage losses and cut costs by making full use of every cubic foot of storage or shipping space."

Packaging requirements

The kind of shipping protection required for a given item depends primarily upon the type of plastic from which it is made, the size, weight, and design of the part, the delivery distance, the value of the product or part, and the manner in which it will be used in the final assembly. Obviously, the packaging requirements for such products, as phenolic control knobs or cookware handles differ greatly from those for a large refrigerator inner door liner molded of styrene alloy. The relative toughness of the plastic involved has an important bearing on the amount of packaging protection.

Frequently the problem is not so much a matter of protecting the item against actual damage as to guard it against marring or scratching which might bar its use in the final assembly. A small radio, for example, if

Fig. 6: Both product and company identification are achieved by Columbus Plastic Products in packaging its line of houseware items in printed polyethylene film (refrigerator set is in cellophane)

Fig. 7: Starter set of Premier melamine dinnerware is packaged in corrugated box which has protective inner partitions. Top flap of box incorporates die-cut display riser

scratched or otherwise defaced during shipment, will not be acceptable to the ultimate purchaser.

The surface design of the package or shipping container depends largely upon whether the product involved is a finished consumer item, to be sold at retail, or an industrial component. In the latter instance, the main point is that the cartons be properly identified as to source, destination, and contents. For consumer items, on the other hand, the value of attractive package design and clear-cut product and manufacturer identity should not be forgotten. This phase of packaging, growing rapidly in importance with the trend to open displays and self-service merchandising, has been highlighted through the informative labeling program developed by S.P.I. in cooperation with various interested organizations.

Points to consider

Some of the points to be considered when a molder or fabricator of plastics is deciding upon how an item will be packed for shipment are:

1) Does the customer plan to re-use the container or employ it to carry the parts through his own production lines? If so, its design and construction should facilitate these operations. By checking with companies buying the parts, the custom molder or fabricator can usually come up with a package embodying the desired features.

2) Can the parts be safely nested to conserve shipping space? This is standard practice for shipping such deep-draft items as polyethylene dishpans and wastebaskets. However, some manufacturers have found that, unless a separating pad is used, wastebaskets may cling together with a virtual vacuum seal, making them extremely difficult to separate at point of sale.

3) Can the package be both filled and unloaded quickly and easily? Even a package having superior protective features should not be used if it is difficult to make up or unpack. If methods of closing the container make it difficult to open without destroying the package

Fig. 8: Electric clock with molded acetate housing is packaged in corrugated box with die-cut pads at top and bottom to protect it against damage while in transit

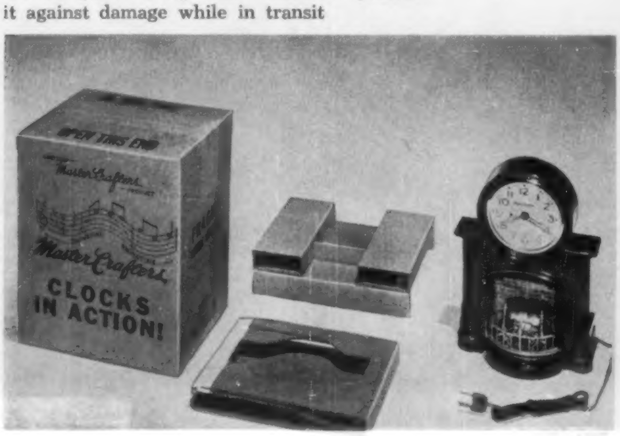


Fig. 9: Two-trip corrugated box is used by molder to ship molded cabinet to radio manufacturer, who then uses the same container to ship the completely assembled radio to his distributors

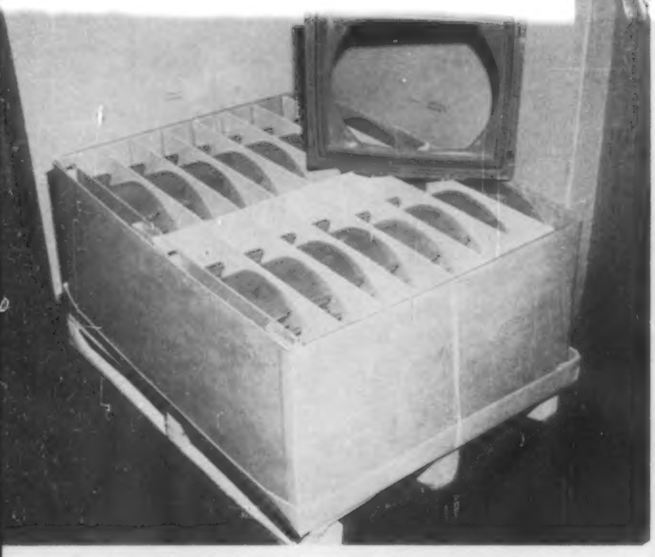


Fig. 10: Another two-trip package. Carton used to ship molding material to molder is later modified to ship molded tube masks to TV maker. (Photo, GATX, Plastics Div.)

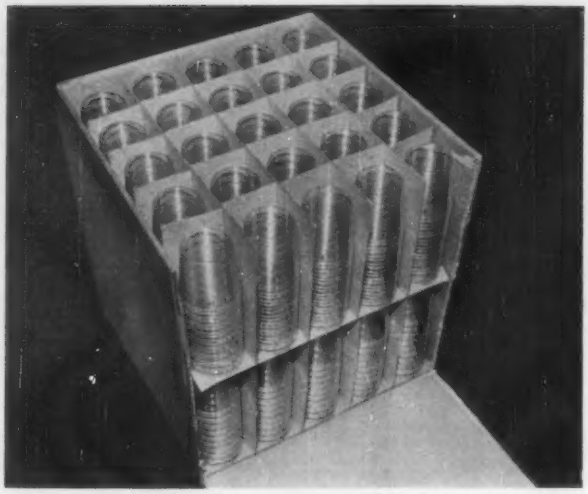


Fig. 11: Re-usable pint-size styrene food containers are safely shipped in two-tier corrugated box with slotted pre-assembled partitions. (Photo, Premium Plastics Co.)

or endangering the contents, consideration should be given to some of the new built-in tear-strip opening devices now offered by many suppliers of corrugated shipping containers.

4) Do the parts to be shipped require a package of special size or construction? Many molders have found it best to limit themselves to a few basic container sizes, thereby avoiding inventory problems with special sizes and the higher unit costs of smaller orders. Containers may be adapted to a range of products through use of partitions, separators, filler pads, and similar devices.

5) Can packages be unitized and palletized to permit efficient handling by lift trucks? Many manufacturing plants now make extensive use of lift trucks in many operations from handling incoming supplies to warehousing and all the way to the production line and shipment of the finished product. However, if the customer's facilities do not include such equipment, packages may have to be kept separate and lighter to permit manual handling.

6) Is the package adopted *too good* for the job? A container which will successfully carry the item long distances and withstand "relay

Fig. 14: Triangular corrugated container for lighting fixture replaces oblong carton at a saving of 30% in space and of 22% in cost. (Photo, Robert Gair Co., Inc.)

Fig. 15: Interior-illuminated acrylic signs by Neon Products, Inc., are packaged in specially designed corrugated containers having inserts to prevent movement within package

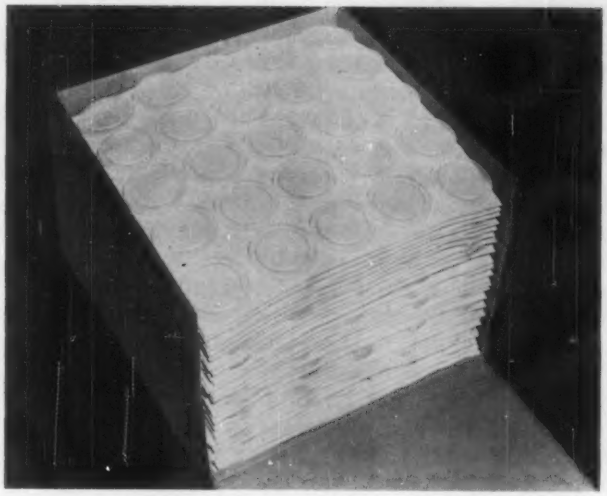


Fig. 12: Molded polyethylene lids for pint containers are packed in corrugated box in layers of 25, separated by sheets of paper. Box holds 1000. (Photo, Premium Plastics)

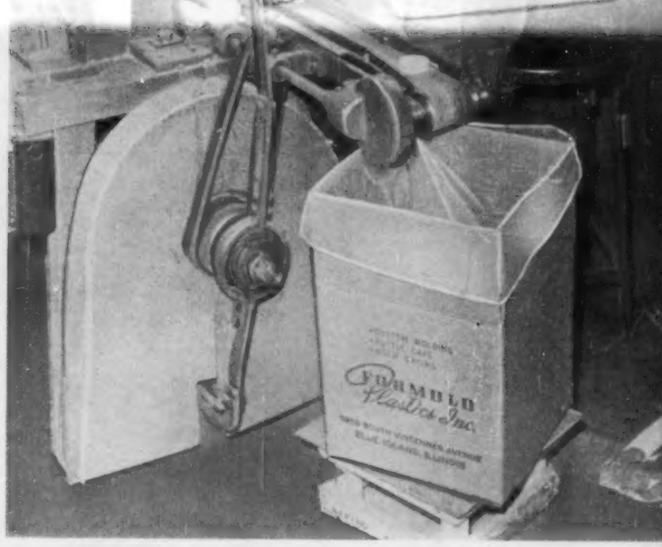


Fig. 13: Plastic closures drop off conveyor into corrugated box lined with polyethylene bag. Bag guards against loss in case carton is damaged. (Photo, Formold Plastics, Inc.)

distribution" involving several carriers may be wasted on purely local deliveries.

Toys and related items

With the increasing swing to self-service merchandising, more and more plastic toys are sold in unprinted polyethylene bags having a saddle-type header label which seals the bag and prevents possible pilferage. Hang-up holes in the top permit the packages to be hung from counter or wall display racks. Toys molded or formed from polyethylene, acetate, impact styrene, and elastomeric vinyl lend themselves ideally to this type of visual packaging because such articles are virtually immune to breaking

Fig. 17: Molded impact styrene drawers are stacked in a 36-in. sq. corrugated box. Corrugated rectangles beneath each drawer prevent it from settling into drawer below

Fig. 16: Wire-bound wooden crates, incorporating suitable interior protection, are used by Neon Products to ship the large-size acrylic outdoor signs that it produces

Fig. 18: Corrugated container for two knocked-down reinforced plastics chairs has inverted U-shaped platform that supports backs of seat shells. (Photo, GATX)

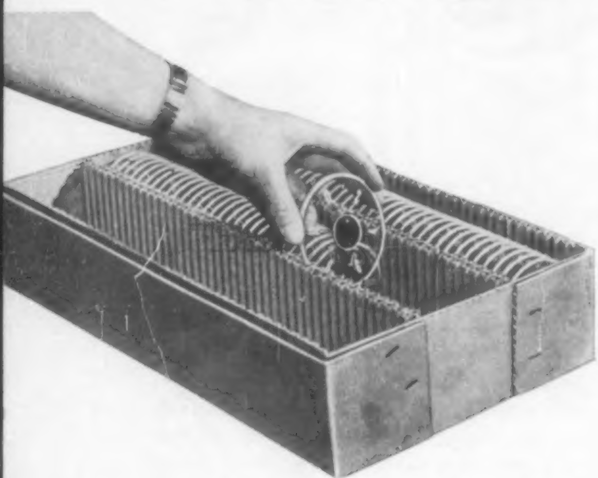


Fig. 19: Cradled between grooves of folded corrugated liner, molded acrylic automotive clock faces can be shipped compactly without damage. (Photo, G. Felsenthal & Sons)

or cracking under normal handling conditions.

Revell, Inc., Venice, Calif., found a corrugated container with tailored die-cut slotted panels the answer to its problem of shipping fully assembled plastic models of the U. S. S. *Constitution* to retail outlets for display purposes. The specially developed container (Fig. 1, p. 115) incorporates ingenious interior packing to protect the hull and deck, the free-swinging lifeboats, and three masts, one of which rises 9 in. above the deck. The hull of the model is embedded in a platform of corrugated, with sides folded beneath and extended to form cushioning beneath the model and at two sides. Two interior partitions, slotted at top and bottom, support cushioning at each end. Two cross-partitions which protect the fragile masts fit into slots at the top of the lengthwise partitions; a small, die-cut sheet of corrugated, folded between the main masts, hugs the sails closely to protect the deck and hold the ship firmly upright.

Heavy-duty paperboard or corrugated containers are used extensively for elaborate and costly toys. One excellent example of such a corrugated container is the luggage-style box used by Proll Toys, Inc., Newark, N. J., for its line of molded plastic musical toys (Fig. 2, p. 115). Equipped with a sturdy integral handle, these packages serve as a convenient carrying case for the instruments following purchase.

Gadgets, housewares

Minnesota Mining & Mfg. Co. encountered—and solved—a stubborn packaging problem in connection with a new molded plastic house-

Fig. 20: Molded acrylic lenses for use on Ford truck tail lights are packed back-to-back in die-cut slots in corrugated sleeves. (See also photo at right)

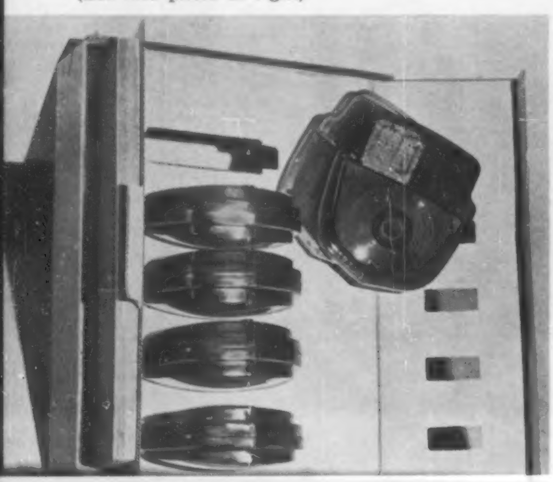


Fig. 21: Slots are grouped off-center to permit interlacing of lenses without their touching. (Photos, Stimsonite Div., Elastic Stop Nut Corp. of America)

hold dispenser for Scotch-brand cellophane tape which can be attached to a wall surface or detached for table or counter use. In studying the packaging requirements for this product, which is molded of red or yellow styrene and sold in combination with a roll of the tape, 3M found that because of the electrostatic properties of the plastic material, the dispenser rapidly collected dust particles. The difficulty was overcome by covering both the dispenser and the roll of tape with a vacuum formed dome of transparent cellulose acetate which holds them in position on a printed display card (Fig. 3, p. 116). With its new transparent cover, the styrene dispenser remains clean and appealing.

Freydberg Mfg. Corp., New York City, faced a somewhat different problem in packaging its new Con-Tact vinyl tape, made in ¾- and 1½-in. widths and supplied in a variety of colors and patterns coordinated with the Con-Tact self-adhesive sheet material made by Cohn-Hall-Marx Co. In order to merchandise both the color range of the tape and the many patterns available, Freydberg selected a formed transparent cellulose acetate sleeve, beaded at each end to hold the round paperboard end labels in place. The containers, which are sold directly from a 48-unit folding display carton and a permanent display rack (Fig. 4, p. 116) supplied to department, syndicate, variety, and hardware stores, provide customers a clear view of the patterns available and keeps the merchandise clean and fresh looking.

The Con-Tact sheet material itself, is merchandised in two forms—bulk rolls, from which the salesperson cuts the amount required by the customer, and in prepackaged rolls containing a 6 ft. length of the material 13½ in. wide, retailing at 98¢. The prepackaged Utility packs, supplied in a printed transparent polyethylene bag whose open end is tucked into the roll, are designed to meet the requirements of self-service selling. Attractively printed in red, blue, black, and white, the polyethylene bag permits visual inspection of the pattern and unlike a wrap cannot come loose, permitting the roll to uncoil. Rolls are sold from a corrugated self-shipper display stand (Fig. 5, p. 116) which illustrates typical uses for the product.

Bulk rolls of Clopane transparent vinyl film, produced by Clopay Corp., Cincinnati, are supplied to variety stores and other types of retail outlets with a printed separator sheet that is cut off the roll at the same time as the film and placed with it in the store package or wrap. This lightweight white sheet, printed in bril-

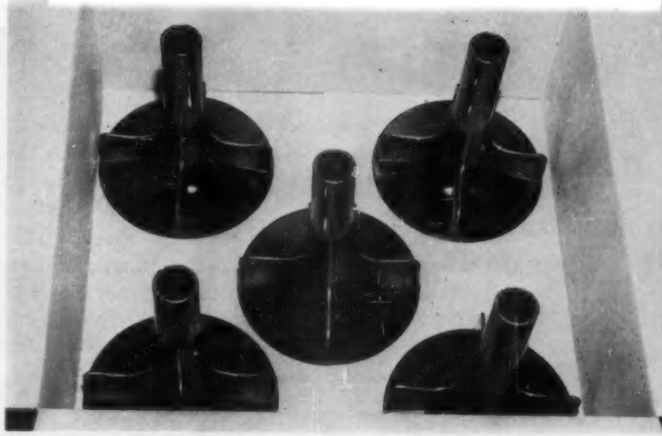


Fig. 22: Shipping molded phenolic washing machine agitators. First, five units are placed upright in bottom of a 350-lb. test double-wall corrugated carton

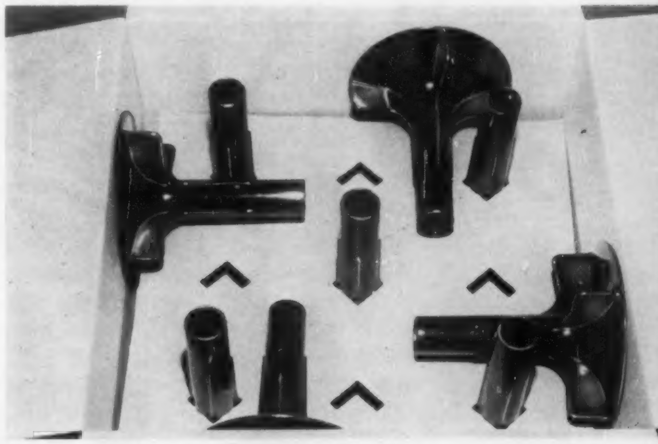


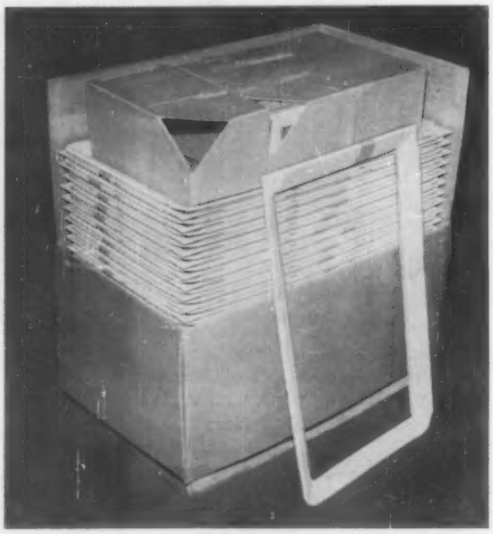
Fig. 23: Die-cut horizontal separators are then slipped over stems and four additional agitators laid on sides along walls, with vanes gripped by slots in corrugated dividers

Fig. 24: Second divider is then placed in container and four final units packed vertically. Containers make from three to six trips. (Photos, GATX, Plastics Div.)

liant red with a repeating pattern, gives specific instructions on how to heat-seal and stitch the film, as well as many helpful suggestions on products which can be made from it. Another advantage of this supplementary sheet is that it calls attention to the Clopane plastic film on the display rack and gives the product immediate trademark identity difficult to achieve with a transparent product.

Coordinated packaging treatment for items made by the same company is illustrated (Fig. 6, p. 116) in a group of typical items made by Columbus Plastic Products Co., Columbus, Ohio. Of the items shown, all those except the three-piece refrigerator set are sealed in printed polyethylene bags. For the refrigerator set, a printed cellophane overwrap is used. In all instances, the wraps are printed with the company's tradename, its green and yellow color scheme, and useful information concerning the products themselves, along with the retail price. The transparent wraps, while protecting the plastic items against dust and handling, permit a full view of the products, colors available, etc.

Fig. 25: Container-within-container technique is used in packaging one-piece molded styrene refrigerator trim frames for shipment. (Photo, GATX, Plastics Div.)



Among the most attractive and soundly constructed packages now being used for plastic products sold directly to the consumer are those adopted by producers of melamine tableware. Since these sets are a relatively "big-ticket" item, the package must be designed to emphasize the quality of the merchandise. Usually these packages are of corrugated construction, incorporating die-cuts and partitions to hold the pieces securely in place. Typical of such packages is that used by Plastics Mfg. Co., Dallas, Tex., for its Texas-Ware Premiere 16-piece starter set. The top flap of this package (Fig. 7, p. 117) forms a display riser featuring the two-year breakage guarantee and the Good Housekeeping seal of approval.

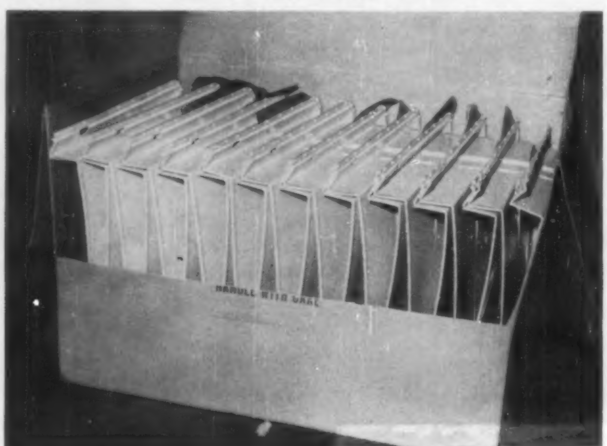
Radios, clocks, TV components

Small radios, electric clocks, and other minor appliances housed in plastics require effective packaging since they are relatively heavy and contain electrical or electronic parts which are easily damaged. Here again, corrugated containers are the favorite pack-medium.

Mastercrafters Clock & Radio Co., Chicago, currently produces a line of (*To page* 228)

Fig. 26: By stacking molded styrene refrigerator door liners back-to-back, and front-to-front, only 13 units could be accommodated in corrugated shipping carton

Fig. 27: However, by using alternate partial nesting, the count was increased to 22 for same size and type carton. Kraft paper protects points of contact. (Photos, GATX)



International

plastics meetings

ISO/TC 61

The Sixth Meeting of Technical Committee 61 on Plastics of the International Standardization Organization (ISO/TC 61) was held in The Hague on September 17-22. Approximately 90 delegates were present from 15 nations, four of which—Hungary, Poland, Rumania, and the U.S.S.R.—were represented for the first time. The countries represented and the number of delegates and observers from them were as follows: Belgium 3, Czechoslovakia 5, France 10, Germany 12, Hungary 1, India 1, Italy 12, The Netherlands 9, Poland 3, Rumania 2, Sweden 6, Switzerland 8, United Kingdom 9, United States 10, and U.S.S.R. 2.

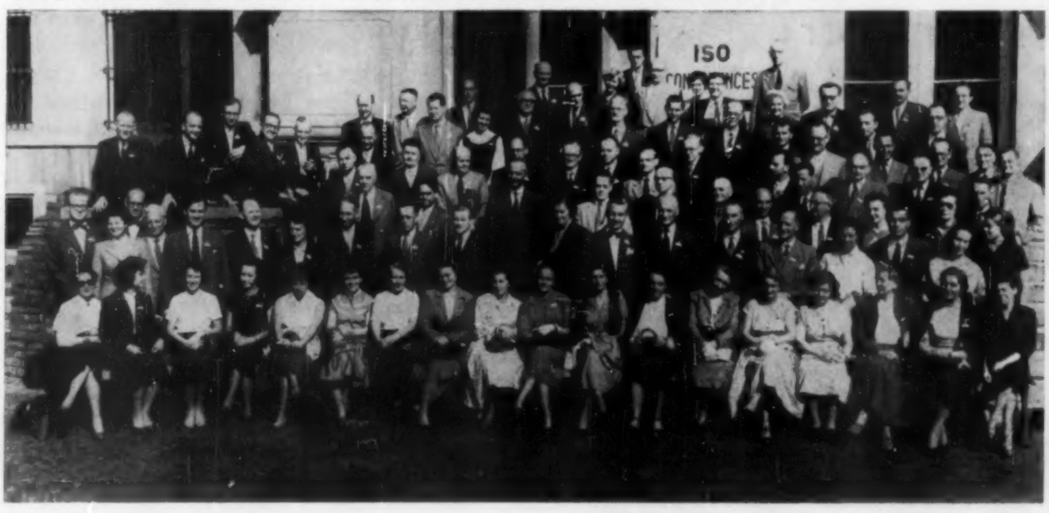
The United States delegation was composed of the following members: H. C. Adams, Monsanto Chemical Co., leader; W. E. Brown, The Dow Chemical Co.; R. Burns, Materials Advisory Board, National Academy of Sciences; C. L. Condit, Society of the Plastics Industry; G. M. Kline, National Bureau of Standards; M. C. Reed, Bakelite Co.; N. A. Skow, Synthane Corp.; A. C. Webber, E. I. du Pont de Nemours and Co., Inc.; P. E. Willard, Ohio-Apex Div., Food Machinery and Chemical Corp.; and E. Y. Wolford, Koppers Co., Inc.

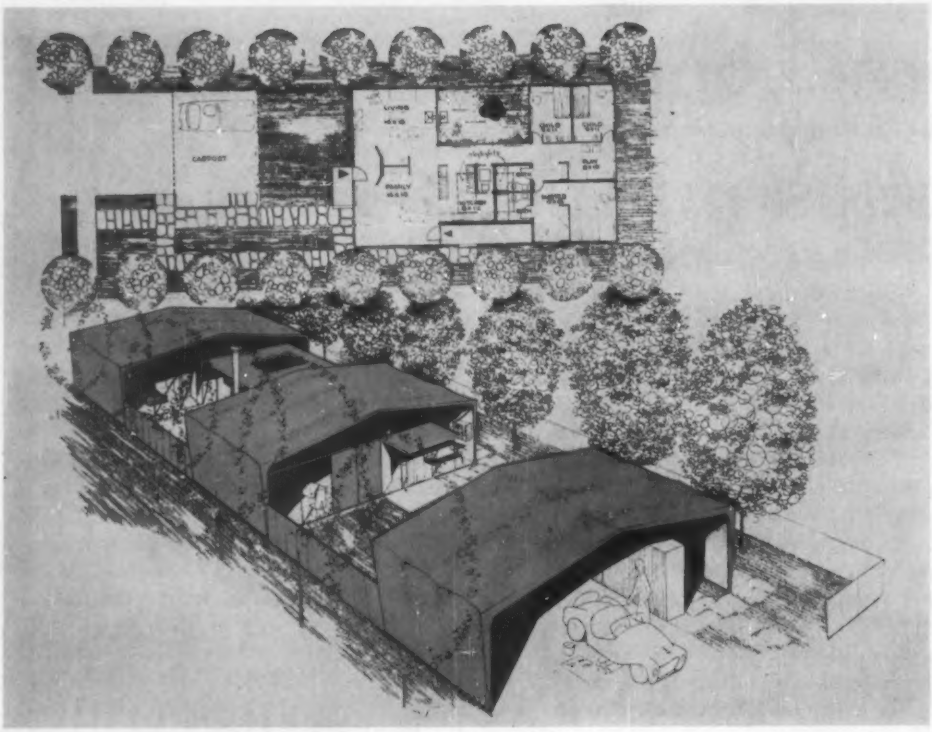
The meeting was presided over by G. M. Kline with D. J. van Wijk as co-chairman. C. L. Condit served as secretary, assisted by N. A. Skow and J. Smit. General organization of facilities and services was in charge of E. W. Westenberg of the Hoofdcommissie voor de Normalisatie in Nederland.

The eight Working Groups of ISO/TC 61 acted on 23 Draft ISO Proposals and Draft ISO Recommendations during the six-day meeting.

The Working Group on Nomenclature and Definitions completed a comprehensive list of equivalent terms relating to plastics in English, French, German, Italian, and Spanish. This list of terms with the addition of the Russian equivalents and unofficial defini- (*To page* 240)

Delegates and wives attending the sixth meeting of ISO/TC 61 in The Hague, Holland





FIRST PRIZE: William Goodwin

Prize-winning designs for Small homes in plastics

In order to increase interest in plastics on the part of architects, builders, and code authorities, the Society of the Plastics Industry's Public Relations Committee conducted, early this year, a plastics house competition in which qualified architects and students from coast to coast competed for cash prizes for designs best utilizing plastics in small home planning.

The rules of the contest called for homes of not more than 1600-sq. ft. area; special sections were devoted to designs for bathrooms, playrooms, and outdoor living or terrace areas.

Professional advisor for the competition was James T. Lendrum, A.I.A., of the Small Homes Council of the University of Illinois. Judges were architects John N. Highland, Jr., Buffalo, N. Y.; Paul M. Rudolph, Sarasota, Fla.; and editor Hiram McCann of MODERN PLASTICS Magazine.

The three top winning houses are illustrated herewith, and they show a common concept in the use of the stressed umbrella principle, known to architects as the "hyperbolic paraboloid." They show also the exploitation of new form through the use of molding techniques combined with sandwich structure.

House No. 1 designed by William Goodwin, Marblehead, Mass., and winner of a $1000 prize, impressed the judges with the orderly discipline of its design and the repetition of standard parts, allowing for a wide range of combinations of indoor and outdoor areas. This house could be easily built on a small lot, sloping or level. The roofs and walls, being continuous in nature and free from complicated openings, offered decided economy in construction.

The second prize of $500 went to Hermes & Colucci, Cincinnati, Ohio, for a house which involved the repetition of a standard umbrella concept, each panel being a tensioned unit. Through the use of these panels, considerable freedom in area use and zoning of living space can be achieved.

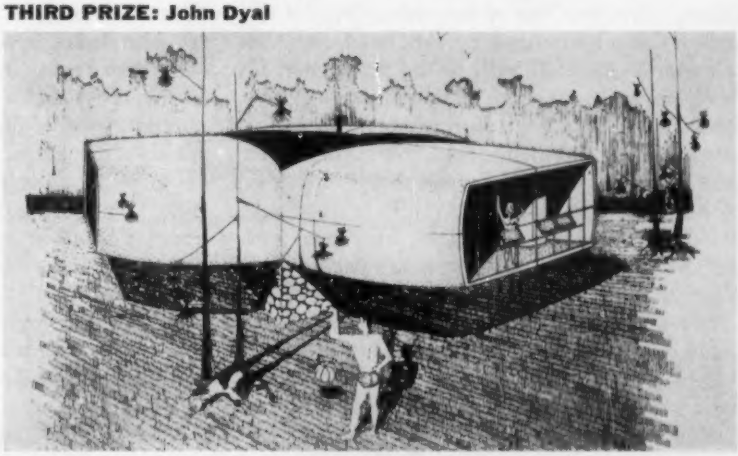
The third prize house, winning $250, was designed by John Dyal of Boston, Mass. There is some similarity between this design and that of the Monsanto-M.I.T. house now being built in Disneyland in California.

Again, elements are created through the use of molding combined with sandwich structure, and the building would achieve its strength through tension. And again, different combinations in area zoning could be achieved through the effective employment of standard components.

The $100 honorable mention in the "Best House" phase of the competition went to Theodore D. Bower, Seattle, Wash. Other winners were as follows: porch and outdoor living area —first prize, $250, Hermes & Colucci; second prize, $100, John Arthur Miller, Cambridge, Mass. Bath or dressing room—first prize, $250, Kinney E. Coleman, Stillwater, Okla.; second prize, $100, John Dyal, Boston, Mass. Playroom (children's or adults)—first prize, $250, Richard B. Frazier, Cody, Wyo. Special Mentions, $75, Eric S. Bodtker, Boston, Mass.; Ralph Dopmeyer, Boston, Mass.; Peter Samton, Scarsdale, N. Y.; and Theodore Turk, Grosse Point, Mich.

SECOND PRIZE: Hermes & Colucci

THIRD PRIZE: John Dyal



Vinyl cast on paper carrier

Process known for 10 years now grows in importance because of versatility needed for today's applications

Reputed by some vinyl experts to be the most versatile processing method for manufacturing film and coating of fabrics is the casting of organosols and plastisols on a paper carrier. Whether used for film casting or for fabric coating, the final product is stripped easily and cleanly from the specially formulated paper, which may be re-used a number of times to process more vinyl.

Information used in the preparation of this article was provided by Walter J. Kaufman, manager, Technical Div., Watson-Standard Co., and John O. Markward of S. D. Warren Co., manufacturers of paper carriers. There are so many minute variations of the technique, naturally jealously guarded by the users of the casting-on-paper process, that photographic illustration was simply not available. The flow charts herewith illustrate the casting of film and the cast-coating of fabric on a paper carrier.

While the technique has been in use for over ten years, very little has been written about this segment of the plastics field.[1] Casting on stainless steel belts accounts for the largest volume of cast film produced, although low capital investment factors as well as wide versatility have attracted a number of companies to the paper carrier method in recent years. Advantages claimed for cast film are: greater latitude in film formulation, thinner and more pliable film, increased transparency, and freedom from directional stresses.

Each of the three principal methods of producing vinyl film has certain advantages. Calendered film is the most widely used, and the calender lends itself both to the production of free films and to the application of vinyl to fabric or paper base. Extrusion permits rapid production of flat or cylindrical webs; the latter may be used as extruded or, by slitting the sides of the web, to produce two flat film areas simultaneously. Cast vinyl is the third principal method and, while still far below calendered vinyl in total yardage, is growing rapidly.

The paper used as a carrier in the casting process is a highly specialized product. Formulated for dimensional stability and for easy release of the cured film, it consists of multiple coatings on a special fiber base.

With the use of this paper as a carrier for vinyl casting, several economic factors are involved.

1) **Low capital investment.** The flow charts herewith show set-ups for both film casting and fabric coating on paper carriers. The set-ups call for a coating device (usually a reverse roll coater), a curing oven, and an unwind stand for the paper at the coating end. Suitable fly rolls for supporting and controlling the paper web are needed. Coating machines used for applying vinyl directly to fabric may be adapted to the use of the paper carrier with relatively little expense. The total machinery investment for this process is much less than for stainless steel belt casting or for calenders.

2) **Re-use and recovery of paper.** On an average, the paper carrier for vinyl casting will have a life of from six to eight uses, and when it is no longer suitable to the process, it may be sold to waste paper dealers for from 10 to 20% of its original cost. Principal factors limiting the number of uses of the paper are mechanical troubles from damaged rolls or weakening of the fibers during the successive heating cycles. For a carrier 60 in. in width, the paper cost per running yard of finished film after an average number of re-uses would be well under five cents, experts declare.

3) **Width of carriers.** Paper for vinyl casting may be obtained in any width up to 90 in. and can therefore be adapted to a wide range of film jobs.

4) **Printing applications.** Some carrier papers are coated with a resin surface designed to accept smooth, uniform printing of special vinyl

[1] U. S. Patent 2,739,919, recently issued, describes some of the techniques in use with a paper carrier. See also U. S. Patent 2,486,258, as well as MODERN PLASTICS 24, 124, Nov. 1946.

inks prior to casting. The non-stretching properties of the paper make for perfect multi-color printing register, and when the vinyl film is stripped off the printed paper, the transferred design becomes an integral part of the film. After stripping, the clean paper is again ready for the casting cycle.[2]

5) **Variety of finishes.** The finish of film cast on paper may be dull or glossy, according to the surface of the paper carrier. And even light patterns may be put into the film by first embossing the paper.

6) **Preventing of blocking.** Vinyl cast on paper does not need to be stripped off the paper at the end of the machine. If desired, the temporary laminate of paper and cast film may be wound up in one roll and set aside until needed for further service. Since the film will release from the paper quite cleanly after indefinite storage, this method prevents any blocking such as is sometimes experienced when film is wound on itself and stored.

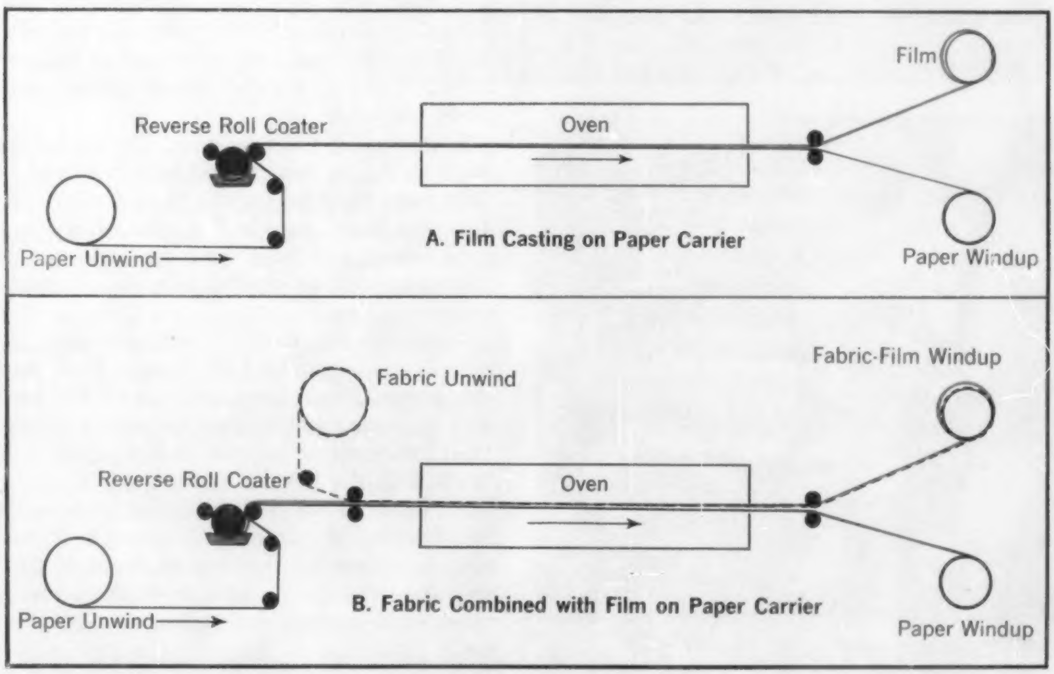
7) **Multiple passes.** When a film is desired with special properties obtainable only otherwise through lamination, different formulations may be cast in successive passes on the same paper carrier. For example, a protective coating may be cast first, and after curing the same roll can be recoated as often as the product calls for before the completed film is stripped off of the paper. Even a printed design can be sandwiched between layers of vinyl.

8) **Controlled release.** Depending upon the type of vinyl resin, the pigmentation, and the solvents and plasticizers built into the vinyl formulation, the paper carrier can be designed to give it a controlled degree of release from the cured film. Most processors require quick and easy release, but there are cases where paper must be manufactured to provide slow release.

9) **Non-stretch fabric coating.** Knit goods, non-woven fabrics, and other stretchable materials may be combined with vinyl films on a paper carrier without stretching. The paper acts as a semi-rigid support, and the fabric may be brought against the vinyl with a minimum of tension. Leaving the stretch in the fabric makes the product better suited to conform to curves on upholstered furniture, luggage, auto headliners, etc.

10) **Thinner films on fabrics.** One of the features of the paper carrier method *(To page 244)*

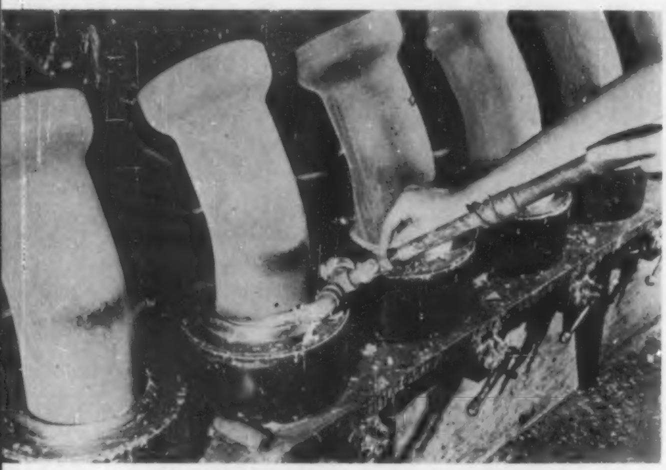
[2]This process is further described in U. S. Patent 2,486,258.



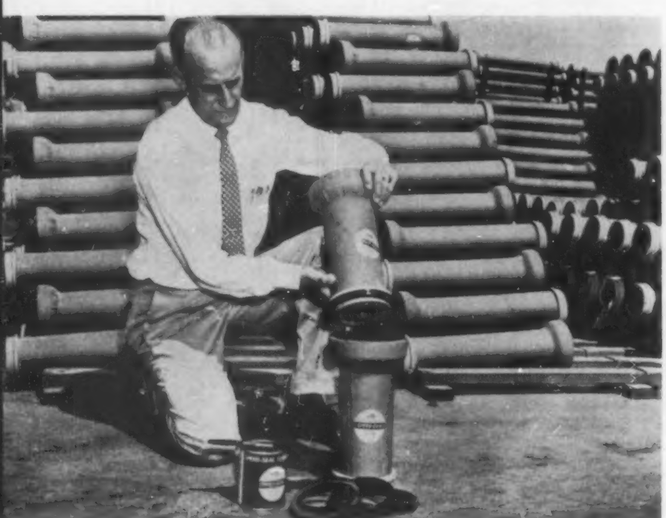
Schematic representation of two vinyl casting processes: top diagram shows elements involved in casting vinyl film on paper carrier; below is set-up for combining vinyl film with fabric on a paper carrier

Polyester in clay pipe joints

Cast to accurate dimensions, rings of reinforced resin back up gaskets in quickly assembled, permanent sewer pipe joints



Polyester resin pours from double nozzle around spigot end of pipe placed in mold, cures to accurately dimensioned ring



After rubber gasket is slipped over spigot and against ring, lubricant is applied and spigot forced into bell for a permanent seal. (Photos, American Cyanamid Co.)

A ring of reinforced polyester resin cast around one end of a length of clay sewer pipe promises to revolutionize sewer pipe joining techniques. With the introduction of the new joint, known as Speed-Seal, cracked joints caused by settling earth, corrosive sewage, and root penetration are no longer major problems. Developed by National Clay Pipe Manufacturers, Inc., Speed-Seal is produced by Gladding, McBean & Co., Los Angeles, Calif.

Clay sewer pipes are conventionally joined by pouring a hot coal-tar compound between the bell and the spigot as the pipe is laid. The use of reinforced polyester in factory-prepared joints results in simpler and more rapid installation, greater flexibility, and a rootproof, leakproof joint. The resin mixture used consists of approximately 50% polyester and 50% mineral filler, with a small amount of chopped fibrous glass. A natural rubber gasket completes the joint.

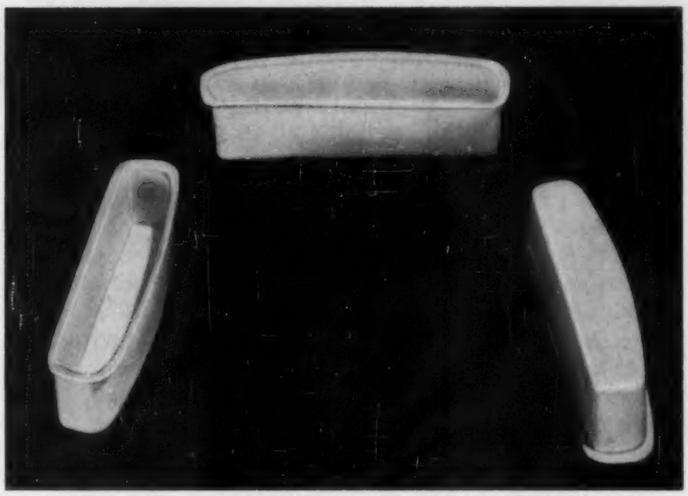
In producing the new joint, the interior of the pipe bell is first ground to a tolerance of 0.010 inch. Next the pipe is heated to 240° F. The preheated spigot end is then placed in a mold heated to 250° F. and the resin mix is poured around the pipe to form an accurately dimensioned ring.

On-the-job installation is very simple. A 50-ft. line can be installed by two men in less than 10 minutes. The rubber gasket is first slipped over the spigot and against the retaining ring. Then lubricant is applied and the spigot is forced into the bell by hand. Because of the compression of the resilient rubber gasket and the absolute roundness of the cast polyester ring, an all-around pressure of about 40 p.s.i. seals the joint. This is well above the pressure required to prevent destructive root penetration.

Credit: Laminac polyester resin supplied by American Cyanamid Co.

Not as easy as it looks

How forming problems were solved for producing venetian blind end caps from polyethylene sheet



Formed polyethylene end caps (right) for bottom elements of venetian blind (above) measure 2 in. long by ½ in. wide and have reinforcing flanges 1/16 in. wide running around the top edges. Production of the caps is shown on following pages

Most commonly heard expression in the thermoforming industry in recent months, particularly now that new sheet materials never before worked with have appeared on the scene, seems to be, "It looks easy, but . . ." No matter how basic the formed shape may be, fabricators have found that there are many instances where standard forming practices must be revised to accommodate the special physical characteristics which are found in some of the newer materials.

Nordic Plastics Co., Inc., Brooklyn, N. Y., for example, was recently faced with what looked like a relatively easy forming job—a polyethylene venetian blind end cap for Fridland Bros., Keyport, N. J. The cap measures 2 in. long by ½ in. wide, is about ½ in. deep, and has a reinforcing flange about 1/16 in. wide running completely around the top edge. It is designed for a force fit over the ends of the bottom elements of the blind to hold them together and form an attractive bottom bar.

Polyethylene sheet 0.030 in. thick was chosen for the application primarily because of its flexibility—a factor which facilitates assembly and eliminates breakage.

The job "looked" easy, but once in production, Nordic engineers found themselves faced with a number of problems that required considerable ingenuity to overcome.

Multiple-cavity mold

Tooling up for the job was begun in a conventional manner. To keep as much wall thickness as possible in the top surface of the cap, where wear would be greatest, it was decided to produce the caps by drape vacuum forming over a series of male plugs mounted on an aluminum plate.

Plaster patterns of the plugs were then pro-

Fig. 1: Mounting holes are drilled into each of the male plugs used for forming the end caps. (Photos both pages, Nordic Plastics)

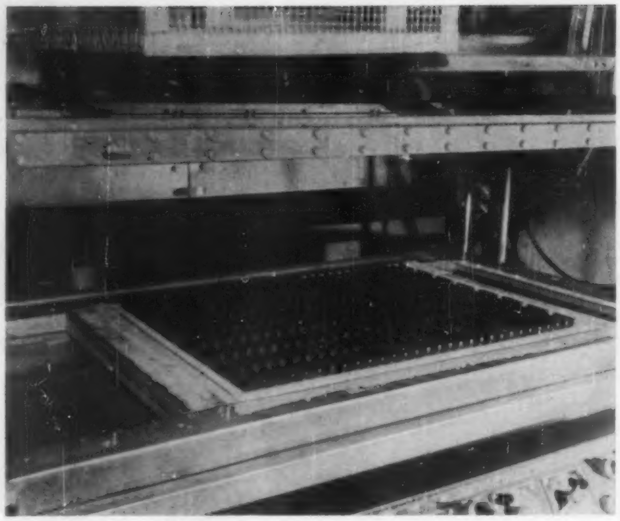


Fig. 2: Two hundred forty plugs are mounted on aluminum plate. Special care had to be taken to insure equal spacing between plugs

duced and a plastic sheet was vacuum formed over these patterns. This formed sheet or "skin" of the sample pattern was used as the female mold into which furane resin plugs could be cast. After curing, the male plugs were sanded flush at the bottom so that they could be mounted flat. Sample pieces were then drawn to make sure of dimensions and shape.

Mounting the plugs on the ⅛ in. thick aluminum plate required care. To meet the order for 1½ million units as quickly as possible, Nordic engineers had decided earlier to mount the plugs in 8 rows of 30 each (for a total of 240 pieces) with about ⅛ in. between plugs. Because of the number of plugs involved, a special multiple jig, designed to maintain equal spacing between plugs, was used for drilling mounting holes in the plate.

Vacuum holes, about ¼ in. in diameter, were also drilled into the metal plate so that they would be positioned directly under each plug. Wood screws fasten the plugs securely in position. Washers on the screws provide clearance between plug and plate to allow the vacuum to be drawn through the holes.

Drape assist frame

Perhaps the most difficult problem faced in engineering the job was the design of a drape assist frame. Because of the close spacing between the 240 plugs, it was found necessary to use a drape assist frame which would descend into the depressed areas between the plugs to prevent webbing at the corners.

Originally, a series of metal web bars, running from one end of the mold to the other and across both the length and the width of the plugs, was designed for the job. A test run was then made—but the results were unsatisfactory. While webbing was completely eliminated, it was found that the formed sheet could not be released from the mold by conventional air blow-off techniques. The more air blown under the sheet, the worse the result.

A study of the mold and the web bars indicated that the flexible sheet did not release under air pressure because of the rigid con-

Fig. 5: When drape frame is raised, sheet is easily lifted out of mold. To facilitate die cutting, sheet is then cut into eight strips

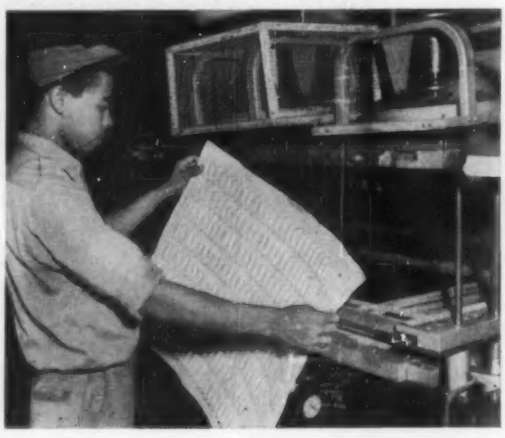


Fig. 3: Polyethylene sheet, 30 mils thick, is laid over mold prior to drape forming operation. Air blower at top is for cooling

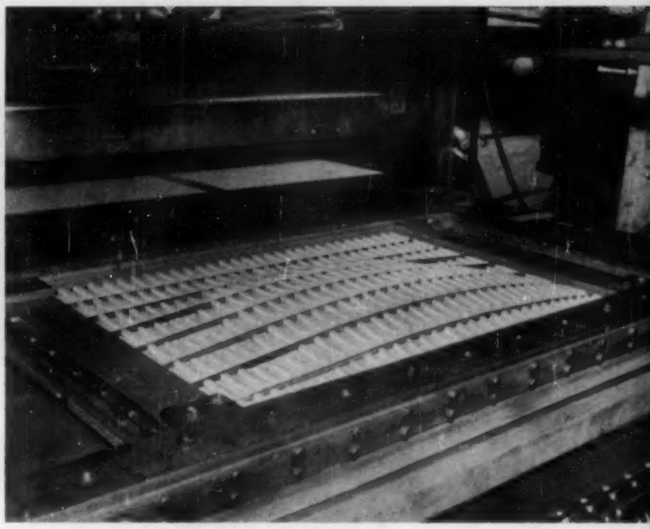
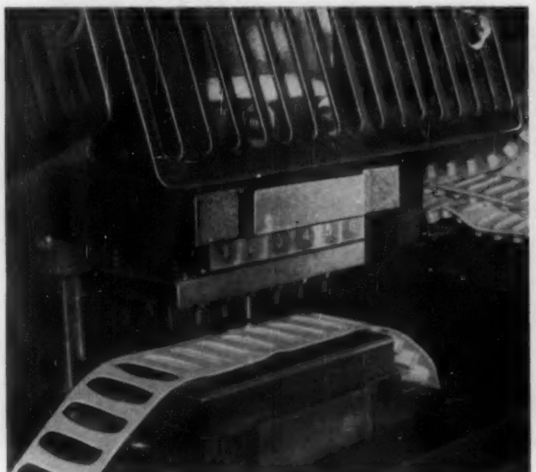


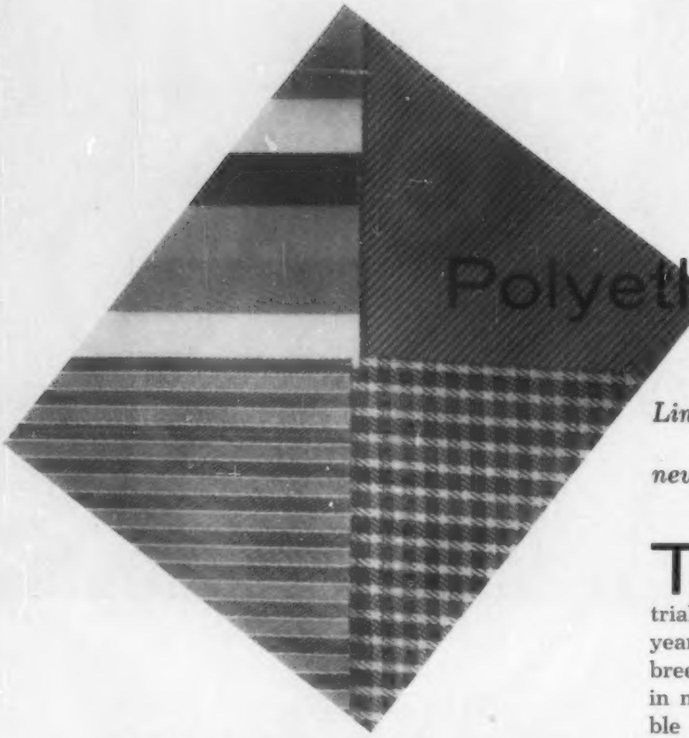
Fig. 4: Because drape-assist frame is made up of series of coil springs, air blow-off forces entire formed sheet up from mold

struction of the bars. The solid bars pressed the soft, flexible polyethylene sheet so tightly against the aluminum plate that there was not enough clearance between bar and plate to allow air to get under the sheet and blow it off. As a result, the polyethylene sheet, in cooling, shrunk tightly around the plug, making removal difficult even by hand. If more clearance were allowed, the problem of blow-off would of course be solved, but webbing again would result. Next step was to suspend the rigid bars on coil springs. This improved results but, over-all, the setup still was unsatisfactory.

The small degree of success thus obtained, however, gave Nordic the idea of replacing the rigid bars with coil springs running from one end of the mold to the other—and this proved to be the perfect answer. When air blow-off is used, the flexible coil springs allow the formed sheet to be forced up and away from the mold base, releasing each and every one of the 240 pieces from the plugs. Moreover, because of the "give" in the springs, the vacuum can do a more effective job in drawing the sheet over the plugs. It was also found that only one set of springs running the length (*To page* 252)

Fig. 6: Each strip is fed into 5-up male and female punch-press die (left). As formed caps pass under the die (close-up, right), a set of male plugs comes down into the cavities of the caps to position strip for die cutting. Finished piece is then pushed out of strip





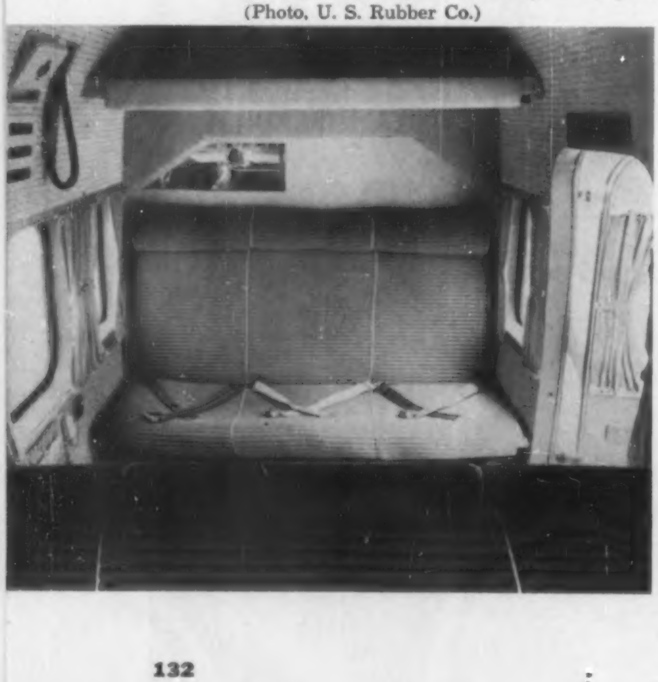
Polyethylene fibers

Linear-type polyethylene monofilaments

new markets and expand present uses of

Fabrics woven of polyethylene fiber in a variety of colors and patterns are slated for application in outdoor furniture, golf bags, awnings, etc. (Fabrics, Reeves Bros., Inc.)

Texture fabric produced through shrinkage of polyethylene fibers in warp is used as upholstery material in Sikorsky helicopter. (Photo, U. S. Rubber Co.)



The doldrums in which polyethylene industrial textiles have found themselves for several years are about to be broken by a healthy breeze of activity which is expected to result in major expansions into heretofore inaccessible market areas. Behind this break in the economic weather for polyethylene fibers is the development of the linear (Ziegler- and Phillips-type) polyethylenes.

Until now, the polyethylene fiber market—serviced by monofilaments of branched-type material—averaged about 1.5% of total polyethylene resin consumption annually, but never exceeded 2 million lb. a year. With the availability of linear polyethylenes, consumption by this market is expected to increase rapidly. In fact, if field tests now being conducted on certain end-use applications prove successful, it may increase manifold.

This anticipated market growth is based on the fact that linear polyethylene monofilaments possess several physical properties that the branched type lacked. The relatively low strength of branched polyethylene fiber has been a challenge to extruders since the day of its introduction. Long before linear polyethylene was announced, modified compounds and processes had been developed to produce filaments with improved physical properties. (See footnote to Table I, p. 249.) However, even with these improved qualities, markets for the fibers were limited and were confined to certain areas in the fields of rope, filter cloths, aerial targets, and novelty fabrics. It remained for linear polyethylene to broaden the base.

Significantly, there are not many applications in which linear polyethylene monofilaments will *replace* those made of the branched

face brighter future

offer superior properties which will open

branched polyethylene fibers

Novelty patterns in upholstery fabrics are produced with core yarns around which have been wrapped polyethylene monofilament binder ends. (Fabrics by Collins & Aikman)

types. The latter have carved themselves a corner of the market and are holding it successfully. The linear types are rather moving into those areas which the branched variety could not crack.

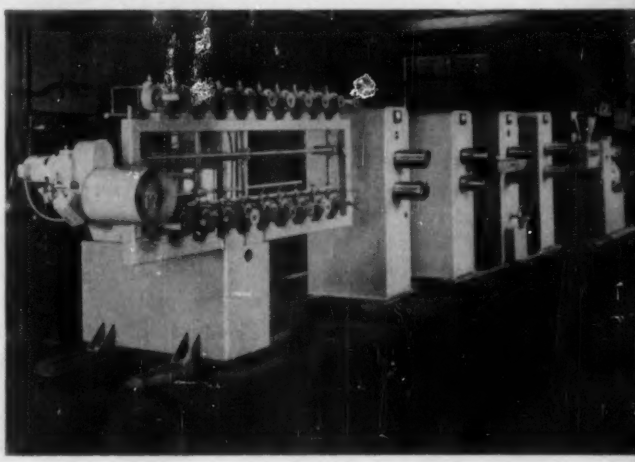
Several firms are currently extruding linear polyethylene monofilament. Reeves Bros., Inc., New York, N. Y., reports that it is in full commercial production, using Koppers Super Dylan and some Phillips Marlex. Dawbarn Bros., Inc., Waynesboro, Va., has already passed the semi-production-quantity stage and will be in full production shortly, using resins from the same sources. The National Plastic Products Co., Odenton, Md., is in production on a limited scale. Others are in the field or soon will be.

Why polyethylene textiles?

The factor that has made polyethylene attractive as an industrial fiber material is its price. On a yard/pound basis it is cheaper than either saran or nylon, principle competitors in the field. Nylon costs about twice as much per pound; vinylidene chloride, while selling for about the same price as polyethylene (ca 40¢/lb.) yields only about one-half the yardage of saran monofilament of a given diameter as polyethylene, because of the difference in specific gravity.

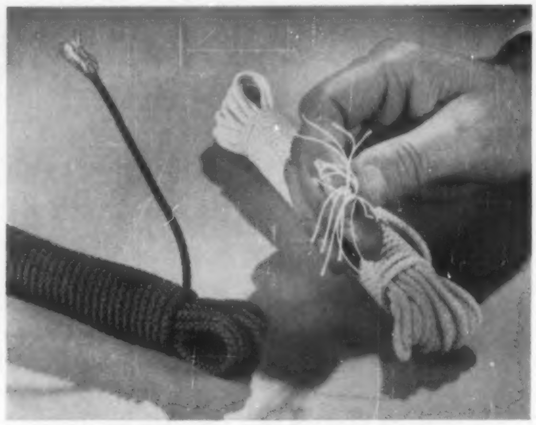
In the past, this price advantage could not compensate for physical properties inferior to those of saran and nylon. As can be seen from Table I, p. 249, tensile strength of conventional branched polyethylene monofilament is only one-third to one-half as high as that of saran and less than one-fourth that of dry nylon, its melting point is below that of saran and particularly of nylon, its tenacity (another meas-

Complete set-up for the production of polyethylene monofilament. Fiber is extruded through multi-orifice die at far right, cooled and annealed by being passed over differential-speed rolls, and wound up on cones at left, ready for shipment to converter. (Photo, Modern Plastics Machinery Corp.)



Rope of various colors, laid with linear polyethylene monofilament (center) is stronger than manila of comparable cross-section and is not affected by long exposure to marine environments. (Rope by Plymouth Cordage Corp., monofilament by Reeves Bros.)

Venetian blind cord of linear polyethylene filament braided over acetate fiber core. Strength and abrasion properties are superior to those of cotton cord. (Cord by Forsyth Twine & Cordage Co., monofilament by Reeves Bros.)



ure of strength, taking specific gravity into account) is less, and its ultimate elongation is higher than that of the other two.

On the other hand, linear polyethylene has properties exceeding those of saran and approaching those of nylon. Such properties, combined with the price advantage, are almost certain to permit linear polyethylene fibers to extend old and take over numerous new markets. In fact, one of the principal extruders of monofilament has stated that woven linear polyethylene is currently being evaluated for all applications for which woven saran is presently being used.

Processing techniques

Like polyethylenes of the branched type, linear polyethylene monofilaments are produced by hot-melt extrusion through multi-orifice dies, with certain modifications in processing conditions resulting from the higher melting point and from greater stiffness of the material. The filaments are extruded, cooled, oriented by being pulled over differential-speed rolls, annealed, and wound on cones for shipment to weavers, braiders, rope makers, etc.

Development of correct processing techniques for linear polyethylene filament extrusion was no easy matter and involved considerable expenditure of time, effort, and capital. Dawbarn Bros., Inc., Waynesboro, Va., for example, reports that it spent over 18 months and consumed several hundred thousand pounds of material before it finally perfected a satisfactory production technique. Reeves Bros. also had to develop special methods of processing this filament. Two major problems, both deriving from the greater stiffness of the material, were 1) the continuous extrusion of void-free uniform filament and 2) their proper coloring. The first problem was solved by the determination of optimum operating temperatures and the second by devising satisfactory pre-extrusion mixing techniques.

The degree of residual shrinkage is controlled during the annealing operation and can be reduced to as low as 1% at 212° F. Light stability is controlled by the use of anti-oxidants and pigments. (Unmodified linear polyethylene as presently available, incidentally, may have poorer ultra-violet resistance than the branched type.)

Applications

Polyethylene filaments in the past have been used in those applications in which the chemical resistance of the material, its hydrophobicity, its low specific gravity, and its shrinkage characteristics were important and where its strength, softening point, and elongation were not.

Ropes: Branched-type polyethylene monofilaments have found uses as barrier ropes in locations exposed to chemical fumes and around

electrical equipment. The striking colors in which they can be laid provide high visibility while their chemical resistance assures long life.

In marine applications, the flotation characteristics of the filament and its resistance to rot, water absorption, and attack by marine organisms have resulted in a market for heaving lines, life lines, and life rafts. Water ski ropes have also enjoyed a degree of popularity. Other branched-type applications are limited by the fact that such polyethylene rope has only half the strength of manila and poor abrasion resistance under severe flexing conditions.

With linear polyethylene this rope market may be expected to expand considerably. For example, linear polyethylene is equivalent or better in strength to manila; unlike manila, it does not deteriorate when exposed to salt water. (Manila rope aboard ships may have to be replaced several times a year.) The deterioration of manila rope is an important cost factor. While the initial cost of linear polyethylene rope is higher than that of manila, it is actually lower when replacement is taken into consideration. For the same reason, industrial usage of linear-type polyethylene rope is also expected to go up sharply.

Polyethylene filaments, because they are readily braided, find use in venetian blind and other cord. The linear type is superior in strength and abrasion resistance to traditionally used cotton cord. The plastic cord is also easier to keep clean.

The total market for all types of polyethylene ropes, currently about several hundred thousand lb./year, is expected to reach perhaps 4 to 5 million pounds of resin annually.

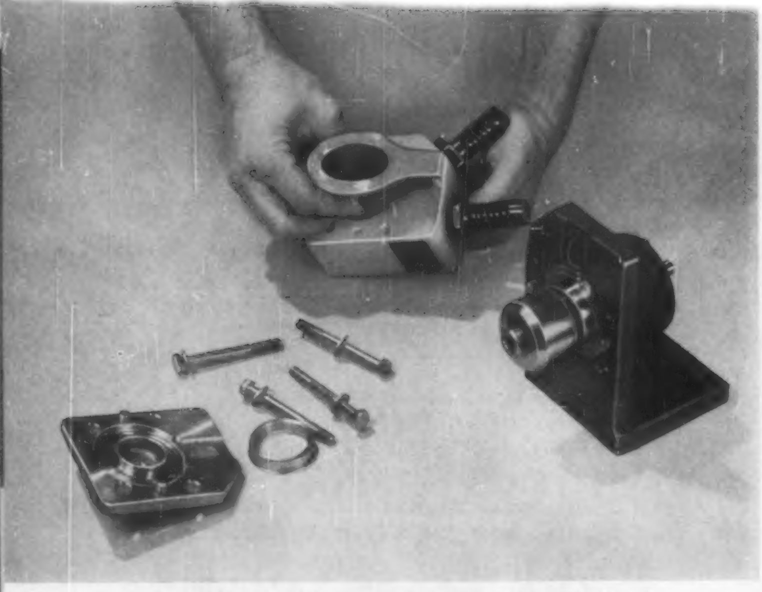
Filter cloths: The electrostatic charges that polyethylene fibers accumulate are used to advantage in air-filtration media. Such polyethylene air filters can be readily cleaned in a water rinse and re-used indefinitely. This rather limited market will not be broadened by linear polyethylene because branched-type material adequately fills the bill.

The story is somewhat different when it comes to chemical filtration. Polyethylene's resistance to alkalies, acids, and saline solutions make it an ideal filter medium. The branched type can be used, after special treatment, at temperatures up to 180° F. Cloth made of linear polyethylene can be used at temperatures above the boiling point of water—thus opening up applications for which branched polyethylene filters are not acceptable. Price of polyethylene filters is considerably higher than that of conventional cotton media. However, according to Dr. Victor L. Erlich, director of research of Reeves, "where the low porosity of a spun yarn filter medium is not needed, the advantage of good cake discharge, good performance against blinding, easy cleaning, and resistance to wear and tear provide considerable savings in the long run." On the other hand, the poor elasticity of linear polyethylene filter cloth limits its use somewhat.

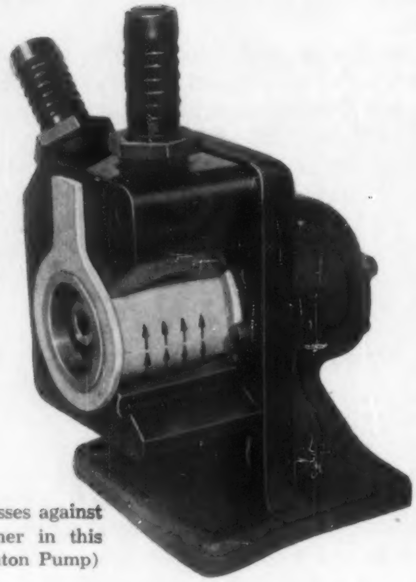
Current market for this application is about 200,000 lb. of resin per year. This could reach the million-pound mark once the linear material becomes more generally available to processors.

3D fabrics: Branched-type polyethylene monofilaments of closely controlled shrinkage have recently found a new market in the production of three-dimensional fabrics. These fabrics are woven flat in various patterns, using combinations of natural and synthetic yarns and polyethylene filaments. After the cloth comes off the loom, it is immersed in boiling water. This shrinks the polyethylene to a predetermined degree (between 35 and 50%, but in any case greater than the shrinkage of the other yarns in the fabric), resulting in puckering and the formation of a three-dimensional fabric. Among the manufac- (*To page* 249)

Air filtration cloth, produced of polyethylene monofilament in a honeycomb weave. Electrostatic charges attract and hold dust particles. **(Cloth by Reeves Bros., Inc.)**



Pump for handling corrosive liquids has flexible plastic liner that is inserted into solid plastic block. Model above has silicone liner, polyethylene block



In operation (cut-away view right), liner presses against inside of block, displaces fluid, (arrows). Liner in this model is Kel-F, block is phenolic. (Photos, Vanton Pump)

Tough pumps for tough jobs

Wherever problems of corrosion or contamination arise in the handling of liquids, plastics pump components offer a solution

Nothing can make the modern pump designer rise screaming from a nightmare more readily than the thought of standard metal pump parts being chewed up beyond repair by corrosive fluids—and probably nothing can sweeten his daydreams more pleasantly than the picture of plastics pump components taking on most any type of hard-to-handle liquid and coming back for more.

Fortunately for pump engineers, plastics have now moved into a top position as prime materials of construction in specialized pump applications. Wherever corrosive acids that will attack even stainless steel are involved, there's a place for plastics . . . and wherever pharmaceuticals, liquid foods, or similar products must be handled without contamination, there, too, is a place for plastics.

Of first importance to the designer in adapting plastics to pump construction is the wide range of materials available to satisfy varying service conditions—from handling mild washing detergents to tackling concentrated sulfuric acid. There is hardly a single thermoplastic or thermoset material that is not in use today for either a major or minor pump component. Even melamine, which heretofore has had limited application in the pump field, is reportedly playing a major role in the design of a new type of pump for aquarium tanks. And intensive research is currently being aimed at trying to adapt some of the newer plastics materials, e.g. high-density polyethylene, polypropylene, nylon, etc.

Pointing up the versatility which plastics thus offer to the modern pump designer are

Molded nylon impellers (circle) for submersible pump (held by model) resist damage by foreign particles in the water. (Photo, Dayton Pump)

Molded styrene alloy valves in this controlled-volume pump are low in cost, can handle many corrosive solutions. (Photo, Goodyear Tire & Rubber)

the activities of Vanton Pump & Equipment Corp., Div. of Cooper Alloy Corp., Hillside, N. J., specialists in the field of plastics rotary pumps. In the construction of the Vanton "Flex-I-Liner" pump, the two major components of the unit—the body block and the flexible liner—are available in any one of eight different types of plastics materials to meet the specific requirements of specialized pumping applications.

Vanton's pump is so designed that the two plastics parts are the only parts to come in contact with the fluid being pumped. Pumping is accomplished by a rotor, mounted on an eccentric shaft, which presses the flexible liner against the inside of the body block. The progressive squeegee action thus put on the fluid between the liner and a groove in the body block results in a positive displacement of the fluid—in much the same way as a roller passing over a flexible hose filled with fluid would result in displacement. Molded-in flanges on the plastic liner straddle both sides of the body block to positively seal off the fluid passage from contact with any of the metal parts of the pump.

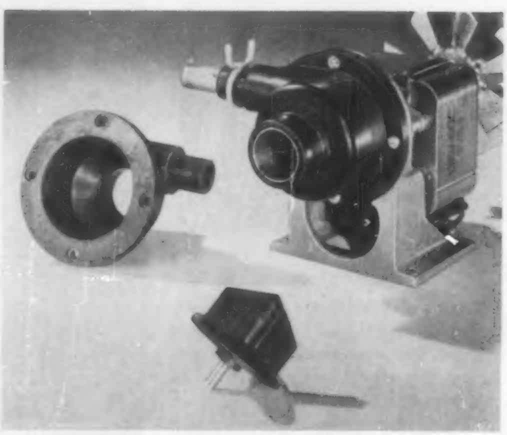
Since the body block and the liner are thus the only two components to be exposed to the action of corrosive or otherwise hard-to-handle fluids, each part can be specified in that partic-

Rugged polyethylene pump, inert to acids, alkalies, and most organic solvent, is manually operated. It can be used with open containers or mounted in a threaded plug designed to screw into carboy neck. (Photos, Bel-Art Products)

Characteristics of plastics used in Vanton pump construction[a]

	Material	*Operating temp. range*	*General chemical service*
Body block[1]	Polyethylene	Up to 150°F.	Excellent for weak and strong acids and weak and strong alkalies; attacked by strong oxidizing acids and aromatic solvents.
	Rigid vinyl	Up to 160°F.	Excellent for weak and strong acids and weak and strong alkalies; resists alcohols, aliphatic hydrocarbons, and oils; soluble in ketones and esters; swells in aromatic hydrocarbons.
	Acrylic	Up to 160°F.	Good for weak acids and weak and strong alkalies; soluble in ketones, esters, and aromatic hydrocarbons.
	Phenolic	Up to 225°F.	Excellent for weak acids and strong reducing and organic acids; excellent for weak alkalies and organic solvents; decomposed by oxidizing acids; attacked by strong alkalies.
Flexible liner[2]	Vinyl	Up to 150°F.	Excellent for weak acids and alkalies; slightly affected by strong acids and alkalies; resists alcohols, aliphatic hydrocarbons, and oils.
	Chlorosulfonated polyethylene	Up to 265°F.	Excellent resistance to dilute and concentrate acids, weak and strong alkalies; exceptional resistance to strong oxidizing acids; good resistance to concentrated mineral acids.
	Polyvinyl alcohol	Up to 150°F.	Extremely resistant to organic solvents; attacked by water, weak acids, and alkalies.
	Silicone	Up to 350°F.	Resistant to weak acids and alkalies.

[a]Prepared by Vanton Pump & Equipment Corp., Div., Cooper Alloy Corp.
[1]Other types of body blocks supplied by Vanton: Buna N hard rubber and stainless steel.
[2]Other types of liners supplied by Vsnton: gum rubber, natural rubber, nitrile rubber, and neoprene.

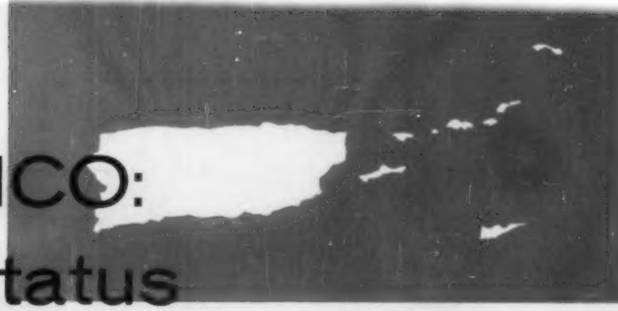


Housing (left) and impeller (foreground) for compact, pump (right) are molded of polyethylene. (Photo, Eastman Chemical)

ular plastic construction best suited to the job. Vanton already makes available body blocks molded either of polyethylene, rigid vinyl, acrylic, or phenolic and flexible liners molded of vinyl, chlorosulfonated polyethylene, polyvinyl alcohol, or silicone—in addition to a number of blocks and liners molded of synthetic rubbers (see chart, above).

Corrosion resistance

Because of its plastic construction, the Vanton pump is specifically recommended for a wide range of applications where corrosive materials must be handled. The chemical and pharmaceutical industries, in particular, have proved to be important volume markets for the pumps. Similarly, the plastics pumps are ideally suited to applications in (*To page* 254)



PUERTO RICO: unique tax status brings results

*By E. T. Ellenis**

More than 1000 miles distant from its major markets in the Continental U. S., a rapidly growing plastics processing industry has sprung up in Puerto Rico since 1950. This young 37-plant, $7 million industry is American in technique, ownership, and product. It is flourishing despite the fact that until now, virtually all raw materials have been shipped from the U.S. mainland to this self-governing Commonwealth, and finished products shipped back along essentially the same route to key markets.

*Technical Editor, Economic Development Administration, Commonwealth of Puerto Rico.

Presented here are the 12th and 13th articles in the series "Wide World of Plastics" which started in our May issue.

These authoritative articles are written by plastics publication editors or industry leaders. The purpose of the series is to show the progress of plastics throughout the world.

In each succeeding issue, countries not checked in the list at the right will be represented.

Argentina
Australia
Belgium
Brazil
France
Germany (West)
Great Britain
Holland
India
Israel
Italy
Japan
Luxemburg
Mexico
Norway
Puerto Rico
Spain
Sweden
Turkey

Covered in this issue

In previous issues

Its outside dependence for plastics raw materials will probably continue for some time to come. There have been rumblings of late, however, that the beginnings of a petrochemical industry in Puerto Rico may hasten the end of this dependence.

Union Carbide's decision to build a $28½ million ethylene glycol plant in Puerto Rico close to an already established oil refinery, signalizes the birth of petrochemical making in the island. Since ethylene is a starting point for both ethylene glycol and polyethylene, it is entirely possible that Union Carbide may at some later date branch out into production of this plastic in Puerto Rico.

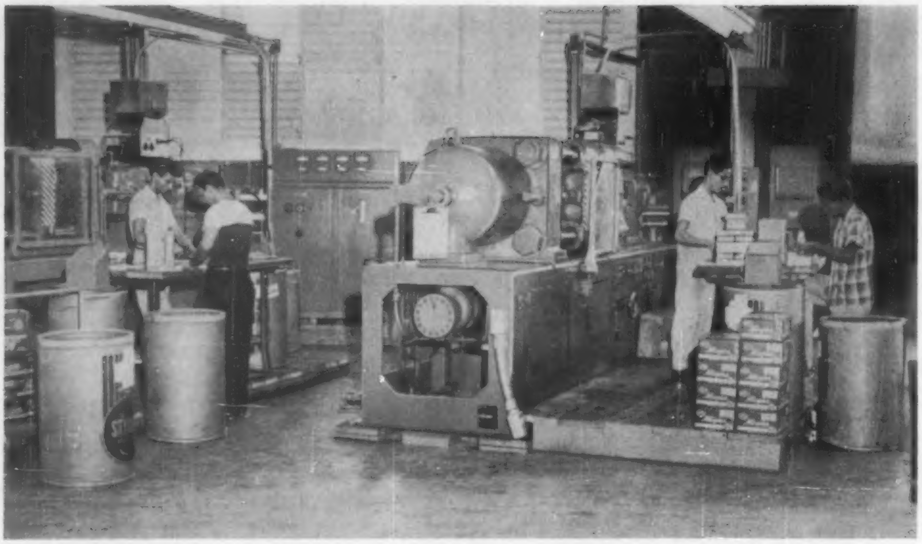
Federal tax freedom and labor savings (average plastics wage: 67 cents) are prime reasons why one new U.S. plastics affiliate opens its doors every two months in Puerto Rico.

Equally important is an ample labor supply (surplus: 100,000 Puerto Ricans), rising worker productivity, development of machine repair and tool and die shops, as well as local tax exemption for a decade.

Thorns in this roseate picture include higher transportation costs, occasional shipping delays, need for extra inventory capital due to long supply pipelines, and the diminishing but still present language barrier.

Put rising worker efficiency, tax and labor savings aside, and rather specialized reasons will be found for plastics expansion in this Spanish-speaking area with close U. S. ties. For example: A Philadelphia film extruder set up a polyethylene film affiliate in Puerto Rico because he wanted to be close to markets in Latin America along with the 100-plant textile industry in the Commonwealth, which uses the plastic film for packaging.

In New England, a manufacturer of fluorocarbon tape chose Puerto Rico because of the



Wall tile, one of many styrene products made in Puerto Rico, being molded in the plant of P. R. Industrial Plastics, an affiliate of Yardley Molded Plastics Co., Columbus, Ohio

island's temperate climate (average degree day 75°), which is important, he claims, in the handling of this sensitive plastic.

A Midwest molder expanded to Puerto Rico when he found it more economical to tap growing Southeast U.S. markets from there than from his Midwest location.

"Operation Bootstrap"

The swift growth of plastics making in Puerto Rico is tied directly to "Operation Bootstrap," the Commonwealth's tax-free industrialization program dedicated to improving living standards for its 2¼ million U.S. citizenry.

Just five years ago, Bootstrap had attracted only three plastics plants. Annual shipments to the mainland totaled $750,000. Principal product of the neophyte industry was styrene toys. Since then the number of U.S. plastics affiliates has grown to 37, not counting the many integrated "captive" molding departments maintained by electronics and other manufacturers. General Electric's circuit-breaker affiliate in Palmer, for example, includes a separate phenolic molding department.

U.S. plastics companies currently participating in Bootstrap's program include Hellmich Mfg. Co., St. Louis, Mo.; International Molded Plastics, Cleveland, Ohio; Yardley Molded Plastics, Columbus, Ohio; American Kleer-Vu Plastics, Maspeth, L.I.; Rellim Industries, Philadelphia, Pa.; Bonney Mfg. Co., Auburn, Mass.; and International Glass Fibre, Inc., Baltimore, Md.

Included in the 37-plant total are injection molders (10); extruders (3); compression molders (5); fabricators (11); and assemblers (4). They use raw material in the form of powders, liquids, sheets, rods, tubes, and granules.

In 1955, plastics shipments to the mainland reached $7 million, a new record. And with shipments for the first five months of 1956 well past the $4 million mark, it appears that the 1955 peak will be eclipsed by a wide margin.

From polystyrene toys in 1950, plastics makers have branched out to mass production of dishes, housewares, pens, electric shaver housings, insulating and building materials, sprayers, vaporizers, atomizers, wall tile, phonograph records, screwdriver handles, cameras, coil forms, spectacle frames, and molds and dies. In addition, PolyPane Packaging Co., San Juan, produces polyethylene film extruded in 60 in. sheets, wound into 50 lb. rolls.

Annual consumption figures show that Commonwealth molders used more than two million lb. of styrene in 1955, as well as 600,000 lb. each of vinyls and cellulosics.

Melamine and urea accounted (combined) for 2¼ million lb. with one molder, International Molded Plastics, San Juan, alone consuming 500,000 lb. of melamine. (International pays one cent a pound over the mainland price

for its landed resin.) Phenolic at 40,000 lb. per year should pick up due to the continued expansion of mainland electronics companies to Puerto Rico. Polyethylene usage, still small, is coming along fast.

Diversification and integration

Two trends stand out in the Puerto Rican plastics scene. One, product diversification as exemplified by 1955 developments when newcomers ranged from camera molders to dish producers, and on to this year, when they include the above mentioned manufacturer of Teflon tape. Two, the swing toward complete production integration from resin to packaged plastic product—all in Puerto Rico. Frawley Corp., for example, began to assemble the Paper Mate pen here four years ago. Today, its Salinas operation, Paper Mate of P. R., Inc., turns out more than 90,000 pens a day (10 million a year), making all plastics parts as well as refill cartridges in the process.

One reason for growing integration is the parallel development of machine repair and tool and die shops. The latter, for instance, now number ten, including Monitor Industries, which began Puerto Rican operations ten months ago and soon expects to double capacity. Another reason: the Commonwealth's 11 vocational schools which turn out 6500 graduates each year, including 50 in tool and die courses, 150 in machine shop courses.

It is obvious that the main reason why Puerto Rico is attracting U.S. industrial expansion is its unique tax status. Manufacturers in Puerto Rico pay no federal taxes since the Commonwealth has no vote in Washington. The table below shows what this means to plastics molders and fabricators:

Net profit after U. S. Corporate Income tax.	*Net profit in Puerto Rico.*
$ 29,500	$ 50,000
53,500	100,000
245,000	500,000

New plastics manufacturers get an additional tax bonus. Under Bootstrap, local taxes are suspended for ten years from the day a molder or fabricator begins operations.

To be eligible for local tax freedom, mainland plastics companies must set up new or branch plastics plants. "Run away" installations, which cause unemployment back home, are not permitted to participate in Puerto Rico's industrialization program which includes technical and financial assistance, help in screening and training workers, and a reserve of modern multi-purpose one story plant buildings for lease at reasonable rates.

Puerto Rico's Economic Development Administration is in charge of attracting, counselling, then assisting on the spot, mainland plastics companies which expand to Puerto Rico. EDA has offices in New York, Chicago, and Los Angeles.

For example, EDA's mainland headquarters, 579 Fifth Avenue, New York, provides information on types of basic and intermediate chemical materials now available in Puerto Rico for use by plastics makers. The agency's economists prepare custom-made reports which compare Puerto Rico with any other site named by the plastics company desiring the survey.

Some bulky plastics products, classified as "balloon freight," often cost too much to ship from the Commonwealth to the mainland unless they can be nested. Otherwise, tax and labor savings cannot overcome this disadvantage. However, such operations might be

Melamine dinnerware is produced in Puerto Rican plant of International Molded Plastics Corp.; material used, 500,000 lb./year

profitable should the market be Puerto Rico itself or nearby Latin America.

Relatively high profit margins for plastics affiliates are the rule rather than the exception in Puerto Rico. In one recent year, plastics makers as a whole averaged 16% profit to annual sales. Individually, fabricators netted 36%, assemblers 21%, with processors on the lowest rung with 5 percent. One 1955 report dealt with eight of the companies in the field and found that they averaged 7.7% net profits.

But there is no getting around the geographical fact that Puerto Rico is 1000 miles away from Miami, 1600 miles from New York. However, the Commonwealth is ideally situated in terms of central location in respect to Atlantic and Gulf Coasts. Plastics makers can tap Boston, Baltimore, Charleston, Mobile, New Orleans, and Houston by ocean freight without having to pay exorbitant overland freight costs from distant mainland parent plants.

Most finished plastics products shipped by sea from Puerto Rico to the mainland carry rates of 38¢/cu. ft. or $1.11 for 100 pounds. Phonograph records—51¢/cu. ft. or $1.25 for 100 lb., and spectacles 60¢/cu. ft. or $1.49 a hundredweight.

Ocean shipping rates on raw materials range from 38¢/cu. ft. for expanded polystyrene to 60¢/cu. ft. or $1.49 for 100 lb. of shipments for chemicals.

Sunglasses being assembled in the Puerto Rican plant of Rosánne Optical Mfg. Co., affiliated with Vision Products, Newark, N. J.

Furthermore, in the case of polystyrene resin, major producers make a practice of selling resin to island molders at mainland prices. At least two producers maintain large polystyrene stocks in Puerto Rico.

In some instances, shipping by air pays. Air freight ranges from 17 cents a pound for shipments over 3000 lb. to 22 cents a pound for shipments less than 100 lb., for shipments between Puerto Rican cities (San Juan, Ponce, and Mayaguez) to New York. One airline carries a lower rate of 10 cents a lb. for shipments between the Commonwealth and New York weighing 9977 lb. and over.

Wage minimums rising

As Puerto Rico industrializes, wage minimums rise. But average wages still lag considerably behind those prevalent in the mainland. A worker in the Commonwealth's sprayer and vaporizer division currently has a minimum of 75 cents an hour. This is due to rise to $1.00 in January 1957. Sixty cents an hour is the floor for the wall tile, dinnerware, and phonograph record division, and 53 cents for the general division.

A recent EDA survey has found that Puerto Ricans reach 90% of mainland productivity levels after two to four months training. Maintenance men learn their trade after eight months of training. Reject rate is slightly higher than in mainland plants, but usually declines after training. Absenteeism in this 1000-man-plus industry, has been running only about 4% monthly.

According to Joseph D. Fox, plant manager, International Molded Plastics: "Our reject rate is about the same as in the States. For repetitive production jobs requiring rhythm, no worker in the world can beat the Puerto Rican. Three months after we opened the plant last year, my workers were producing a set of plastic dishes every 120 seconds."

Personnel Manager, Hellmich Mfg.: "Frankly, I believe that we don't have too much of a problem in training Puerto Ricans. You should have patience. A few show they are not going to be good and we let them go."

C. J. Luster, President, Pan American Plastics Corp., an affiliate of Lincoln Plastics, N.Y.C.: "Our growing confidence in the Puerto Rican worker and Puerto Rico has resulted in a continuing investment in our plant of additional capital and equipment."

SPAIN: growth under difficulties

*By Dr. J. Fontán-Yanes**

This year the plastics industry in Spain is undergoing an important transformation. Up to the present the industry has been imbalanced, the processing portion having grown much faster than the materials section. We now have about a thousand plastics processors of all kinds. Fifty of these are fairly large companies with modern equipment, design departments, and mold-making facilities. Next come about 250 medium-sized enterprises. The rest are small shops, some being "home handicraft" fabricators of plastics sheets and rods.

Except for phenolic and urea resins, these processors have had to depend on imported materials. There is some production of polyvinyl chloride and acrylic, but not enough for the market. And Spain's lack of foreign exchange has not only hampered processors by causing shortages: it has led them to market those articles on which they can make the most profit in small production and it has caused serious price fluctuations.

The industrialization program now underway in Spain promises to provide basic raw materials for plastics, especially from the two large oil refineries (Cepsa in Santa Cruz de Tenerife and Repesa in Cartagena) and from the iron industries of the northern part of Spain, particularly the one at Avilés. Already secondary interests are planning polymerization facilities based on these materials.

As soon as we have materials available, we may expect lower and more stable prices, a balanced growth, and normal consumption.

Thermosets in Spain

The main use of phenolic, of which there is a good national supply, is in molded parts for the electrical industry. In recent years there has been a growing use of phenolic resins in plywood and for other bonding purposes.

Spain also has adequate production of urea resins. Last year a urea resin plant was built by Compania Aragonesa de Industrias in Sabiñanigo (Huesca). There are produced molding materials, adhesives, and paper and textile treating resins.

Melamine, all of which is imported, is used mainly for making tableware. This year the manufacture of decorative laminates was started and a project is under way for melamine resin manufacture based on imported raw materials.

In 1955 polyester production was started in a small way in Spain. A new plant is now under construction in Madrid. A large demand

Plastics materials in Spain

Materials	*Capacity 1956*	*Capacity 1955*	*Imports 1955*	*Exports 1955*
	1000 lb.	*1000 lb.*	*1000 lb.*	*1000 lb.*
Thermoplastics				
Acrylics	1,200	785	77	48
Cellulosics	500	275	737	—
Fluorocarbons	—	—	—	—
Nylons	1,000	—	51	—
Polyethylenes	—	—	1,243	—
Styrene polymers	—	—	2,838	—
Vinyls	11,000	2,695	198	—
Thermosets				
Aminos (melamine and urea)	5,500	3,850	1,012	—
Phenolics (molding, laminating, and industrial resins)	6,000	5,687	—	—
Polyesters	500	26	—	—
Epoxies	—	—	110	—
TOTAL	25,700	13,318	6,266	48

*Plastics Department, Superior Board of Scientific Research, Madrid, Spain.

Spanish Plastics Manufacturers

Phenolics

Unquinesa, *Bilbao*. Molding, laminating, and specialty resins. This company is the main supplier for the Spanish market.

Rutilita, *San Sebastian*. Molding and sundry specialty resins.

Ortoplast, *Barcelona*.

Vikalita, *Valencia*. Laminating resins.

Other companies equipped to manufacture phenolic resins include: **Acxadi, *Madrid*; Aismalibar, *Moncada (Barcelona)*; Vidrimar, *Valencia*; Iso-Vitrificados, *Barcelona*; Olama, *Madrid***; and **Resisa, *San Celoní (Barcelona)*.**

Urea

Unquinesa, *Bilbao*. Molding material, adhesives, and specialty resins.

Aicar, *Barcelona*. Molding material, adhesives, and specialty resins.

Rutilita, *San Sebastian*. Molding material.

Acxadi, *Madrid*. Adhesives and varnishes.

Polyesters

Resisa, *San Celoní (Barcelona)*.

Acrylics

Plexi, S. A., *Valencia*. Monomers and acrylic sheets, tubes, and rods. Capacity in 1956 will be 600,000 pounds.

Uniplex, *Valencia*. Monomers and acrylic sheets, tubes, and rods of methyl methacrylate under its own patents. Capacity in 1956 will be 130,000 pounds.

Riaño, *Santander*. Monomers and acrylic sheet.

A number of companies in Spain prepare methyl methacrylate monomer by depolymerizing cuttings, chips, and shavings. The most important of these companies is **Guiasca, *Barcelona***, which also manufactures sheets. Other organizations include **Sociedad Española De Productos, De Sintesis, *San Adrián de Besós (Barcelona)*; Canfe, *Cornellá (Barcelona)*; Jose Palacio, *Barcelona*; Ramon Padilla, *Barcelona*; Meseguer, *Sardañola (Barcelona)*; Plasticos Plaver, *Sardañola (Barcelona)***; and **S. A. Grover, *Gerona*.**

Cellulosics

Union Española De Explosivos, *Nueva Montaña (Santander)*. Cellulose nitrate. Manufacturing capacity: 230,000 pounds.

Capella, *Barcelona*. Regenerated cellulose nitrate.

Inacsa, *Barcelona*. Cellulose acetate.

Polyamides

Inquitex, *Guipuzcoa*. Caprolactam.

Perlofilm, *Madrid*.

Vinyls

Polycloro, *Hernani (Guipuzcoa)*. Vinyl chloride for calendering, dispersions, emulsions, and pastes. Capacity 1955, 2,000,000 pounds. Expansion now underway will bring its capacity to 5,500,000 pounds.

Etinoquimica, *Monzon (Huesca)*. Vinyl chloride for calendering, dispersions, and pastes. Capacity by end of 1956 will be 2,800,000 pounds.

Compañia Aragonesa De Industrias, *Sabiñánigo (Huesca)*.

Solvay, *Torrelavega (Santander)*.

Devisa, *Guardo (Palencia)*. Polyvinyl acetate. Production capacity 2,600,000 pounds.

exists for polyesters and, although the problem of the supply of fibrous glass has not been solved, other fields of application are being sought in which fibers other than glass may be used for plastics reinforcement.

The thermoplastic market

Not enough acrylic is made in Spain to serve the country's needs, but a Spanish specialty—mother-of-pearl-like sheets—has achieved great fame throughout the button industry in Europe, and is the only plastic exported from this country. Domestic acrylic producers are now expanding although big capacity of monomers must be limited because of the scarcity of cyanide.

In cellulosics, only nitrate is made in Spain, and only small quantities of that. There is a big demand for cellulose acetate, but it must be imported.

Polyethylene is also in great demand, with scarcity forcing it into housewares and cosmetic packaging, where the processor's profits are better. Polyethylene fiber is not extensively used, but is needed. Various companies are studying the possibility of making polyethylene by low-pressure methods and the whole industry hopes that this will be done in the near future.

Polystyrene, the best known and most used plastic in Spain, is all imported. Demand is always ahead of supply. This makes for unstable prices, misapplications, and sometimes improper design by the use of too-thin sections. Styrene alloy and copolymer sheets are hardly known here, but already the introduction of vacuum forming machines is bringing interest to these materials for refrigerator parts, automotive components, and toys.

The manufacture of styrene monomer in Spain is now possible inasmuch as benzene and ethylene are available. Recently a domestic company, namely Etinoquimica, signed a contract of collaboration with Monsanto for the manufacture of these styrene monomers in this country.

Another project for the manufacture of polystyrene, on the basis of imported monomer, is now in its initial stages in the industrial city of Barcelona.

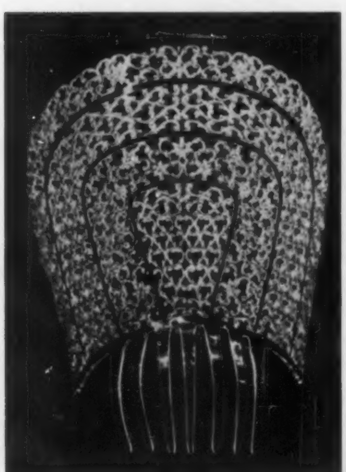
Polyvinyl chloride was the only plastic produced in import quantities in Spain during 1955. Most of it was in the form of film for the manufacture of raincoats, tablecloths, and printed textile fabrics. The consumption of the last two has increased from 1953 to 1955 by 1000 percent. Laminated or coated products for upholstery gained considerably in 1955 and a still greater increase is expected in 1956. During the present year the manufacture of continuous floorings of vinyl chloride and vinyl acetate was started.

Growth of the Spanish plastics processing industry

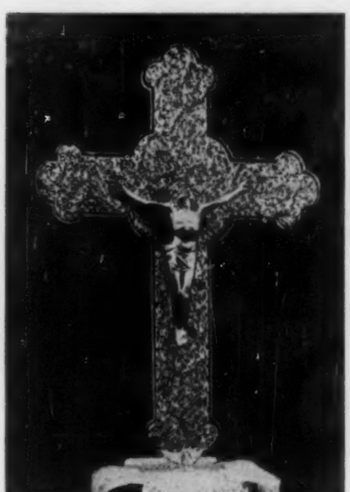
Plant and equipment	*1956*	*1955*	*1954*
Number of molding, extruding, and fabricating plants	1100	1015	824
Number of injection presses	1400	1268	1019
Number of compression presses	800	752	688
Number of calenders	7	6	5
Number of extrusion machines	300	235	189

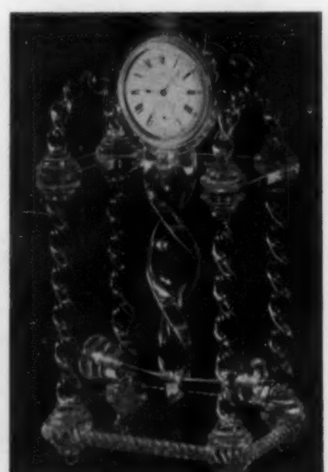
Sheets of rigid polyvinyl chloride are being widely used for the manufacture of industrial parts by welding, and also by vacuum forming. Because of the lack of sheet polystyrene for vacuum forming, rigid P.V.C. is being used extensively in the manufacture of parts for refrigerators. The technique of vacuum forming thermoplastic sheet materials started in Spain in 1955 and we believe that it will develop greatly during 1956.

Spain should have enough vinyl resins for all projected uses this year, and since prices are reasonable enough for the average Spaniard, a consumption increase in vinyl products of approximately 80 to 90% is conservatively predicted for 1956.



Spanish applications of acrylic in decorative and religious items include injection molded pieces and components fabricated from cast shapes





Vinyl foam cushioning

A general-utility inflatable pillow for home, outdoors, and traveling purposes adds comfort to convenience by using a soft, resilient casing fabricated of vinyl foam. To keep air in the pillow when it is blown up, a sheet of 12-gage vinyl film is electronically heat sealed between layers of the foam material.

The vinyl air valve through which the pillow is inflated is also heat sealed directly to the film. Suction cups attached to the foamed exterior of the pillow (which measures 10½ by 13 in.) allow it to be fixed into position on any smooth surface, e.g. as a head rest in the bathtub, as a backrest while reading in bed (photos at right), etc.

When not in use, the deflated lightweight pillow can be folded up and neatly tucked away into the corner of suitcase or traveling bag.

Credits: Cushion manufactured by Vinyl Linens, Inc., New York, N. Y. Vinyl foam supplied by Elastomer Chemical Corp., Newark. N. J.

PLASTICS

Polyethylene garden hose holder

For stowing garden hose out of the way when not in use, a one-piece compact holder incorporating flexible fingers that snugly grip the coiled hose is now being molded of polyethylene. Up to 100 ft. of coiled hose can be hung on the holder—yet the unit weighs only a few ounces.

When using the holder, one end of the hose is simply snapped into one of the two molded-in openings in the holder. The hose is then coiled once and the loop is snapped into the other opening. The rest of the hose is then coiled and held by an extruded vinyl cord which passes through a molded-in hole in the holder. With the coiled hose thus held securely in place, the holder can be hung up most anywhere by the vinyl cord.

Because it is rust-proof, the rugged holder, when not in use, can be left clipped to the hose so that it does not get lost.

Credits: E-Z Snap Hose Holder is manufactured by Home and Industrial Products Corp., Philadelphia, Pa.

for inflatable pillow

PRODUCTS

Embossed vinyl stair treads

Roller embossed to simulate deep texture carpeting, a new line of vinyl stair treads has now been made available for home use. Each of the 3/32 in.-thick pads is installed over the tread and riser of the step that is to be covered, using a special vinyl adhesive.

Besides providing the appearance of expensive carpeting, the stair treads and a companion line of landing mats are longer lasting and far superior to rubber treads and mats in aging and abrasion strength. In addition, the vinyl products have a higher resistance to acids, oils, and caustics and offer outstanding resistance to scratching, scarring, ripping, or tearing, and weigh up to 1/3 less than competitive treads. A non-skid traction texture embossed into the design of the vinyl tread adds to stairway safety.

Credits: Carpet stair treads manufactured by Natco Products Corp., Providence, R. I. Koroseal vinyl supplied by B. F. Goodrich Industrial Products Co., Cleveland, Ohio.

Dr. James F. Carley, Engineering Editor

Mold temperature effects in polyethylene molding

By Charles S. Imig‡

The effects of mold temperature on the injection molding of familiar 0.92-density polyethylenes were studied using a four-cavity test specimen mold, a 12-cavity disk mold, and a spiral test mold in a 4-oz. Reed-Prentice injection molding machine. Further work was done on a 20-oz. HPM using a dishpan mold. Poly-Eth 1005, 1007, and 1008.5 with melt indexes of 2, 8, and 23, respectively, were used.

The results indicated that greater strength and stiffness along with faster cycles were obtained at lower mold temperatures. The clarity was also improved although the effect was greater in thinner wall sections using higher-melt-index materials. The surface gloss of the moldings decreased at the lower mold temperatures when using highly polished cavities; no noticeable change could be detected, however, if the cavities were not highly polished. It was observed that in the molding of smaller parts the actual mold surface temperature usually followed the temperature of the circulating water closely. However, in larger molds such as a dishpan mold, the surface temperature was always considerably higher than the temperature of the circulating water, thereby masking the effect of the low temperature. Even so, faster cycle times were always obtained.

The role of mold temperature in injection molding may be divided into two main categories: the need for efficient, uniform cooling and the need for judicious selection of the best mold temperature for a particular job.

In the first category, it has been stressed that an injection mold must have adequate, properly designed cooling channels. Further, the mold must be operated in such a way that uniform and effective control is obtained. In general, it has been recommended that this may be achieved by giving careful consideration to cooling problems throughout the construction of a mold from initial inception to final mounting in a press.

In the second category, a number of factors have been pointed out which may be affected by the mold temperature. Among these are resistance to flow, physical properties, appearance, and cycle. In particular, it has been mentioned that *the lowest mold temperature possible does not necessarily result in the shortest cycle.* In some cases, additional cooling time may be required to prevent warping of the part or to remove excessive heat required to fill the mold.

Much of the previously published information on mold temperature and its significance has been of a general nature, covering all types of thermoplastic materials, although some specific information has been presented on polystyrene molding compounds. Since polyethylene molding compounds are being used more and more in the injection field, it was felt that there was a need for specific information on the effects of mold temperature on the injection molding of polyethylene. The work presented in this article was therefore undertaken to, at least partially, satisfy this need. Of particular interest was the ability of various polyethylenes to perform well at low mold temperatures. It might then be possible to obtain moldings exhibiting improved properties at faster cycles. This study was limited to the familiar low-density polyethylenes.

Each particular molding job has its own requirements. In one case, appearance might be of prime importance; in another, easy flow;

*Reg. U.S. Pat. Off.

Adapted from a paper presented before the Cleveland-Akron Section of the Society of Plastics Engineers, Sept. 1956.

‡Plastics Laboratory, Spencer Chemical Co., Kansas City, Mo.

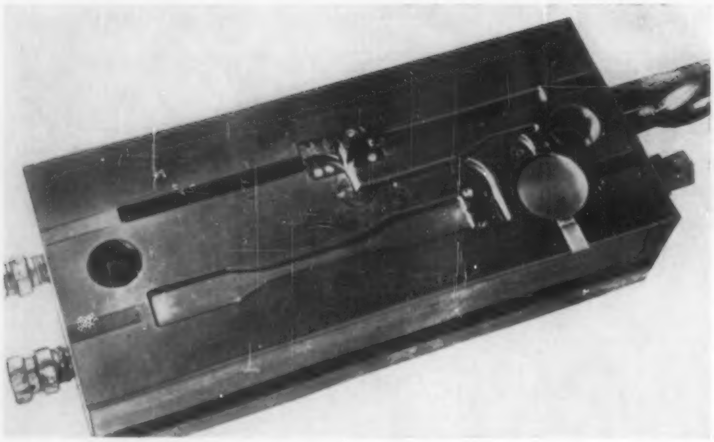


Fig. 1: Four-cavity mold run in a 4-oz. machine was used for injection molding physical test specimens

in another, uniform shrinkage to maintain proper fit; and in still another, stiffness. It goes without saying that the molder must produce a completely acceptable molding in the shortest time no matter what the job may be. In order to view the situation more fully, then, the effects of mold temperature were studied, using several different molds and two different machines.

Materials

The polyethylenes used were all resins in the 0.92-density range. Most of the work was done with Spencer Poly-Eth 1007 and 1008.5 having melt indexes of 8 and 23, although the data on physical properties were obtained with Poly-Eth 1005 having a melt index of 2. While the terms melt index and density have been widely used in identifying various types of polyethylene, brief comment will be made here on their significance.

Melt index or MI is defined as the weight of the material, in grams, extruded through a given orifice, at a specific temperature and under a specific shear stress. This figure is a useful and reliable tool for measuring the ease with which a particular resin might be expected to flow in an injection molding operation. But it does not tell the entire story. This stems from the fact that almost all plastic materials, including polyethylene, are non-Newtonian fluids. This means that the melt viscosity, which Newton postulated to be constant at a given temperature, instead is variable, decreasing as stress increases. There are certain complicated structural differences such as the type and degree of branching along the polymer chain and molecular weight distribution which are believed to exert a profound effect on the extent to which a material will be affected by changes in shear stress. Since injection molding machines operate at much higher shear stresses than the melt indexer, *it is quite conceivable that materials of the same MI may behave differently in the molding machine.* This difference may or may not be noticeable on the machine, depending on how critical the job is. When we can assume the same type and amount of chain branching and molecular weight distribution in a polymer, then the MI becomes a more reliable rating of the ease of flow in an injection machine.

Density of polyethylene is an important fundamental property. Polyethylenes now in commercial or semi-commercial production range in density from 0.92 to 0.96. The important thing for the molder to remember is that the high-density materials are stiffer and can be expected to require somewhat higher molding temperatures and pressures. The comments on MI will be true within a given density range but the great differences in the polymer structure and properties between resins of different densities makes further comparison difficult.

Equipment

The first part of the study reported here was made using a 4-oz. Reed-Prentice injection molding machine equipped with a mold-open timer to insure reproducible cycle times. Even when the operation was not fully automatic, it was felt that this timer was necessary. The mold-open time was set long enough to insure that the operator could open the gate, remove the shot, and close the gate within this period of time, even when encountering some slight difficulties. The cycle times, therefore, were not usually the fastest at which the mold could be run. However, by keeping this setting constant within a given set of samples, it is possible to obtain an accurate relationship of the speed at which the materials could be run.

The last part of this study was made using a 20-oz. HPM injection molding machine equipped with a weigh-feeder. Operation of the machine was semi-automatic and cycle times were recorded as the total clamp time plus 10 sec. for removal of the part.

At mold temperatures above 80° F. a model 6002 Sterlco mold temperature control unit was used. At lower temperatures a Vic model 84, 2-ton refrigeration unit, recirculating water at about 5 gal./min., was used. In all cases,

Table I: Effect of mold temperature on appearance of test specimens

Cylinder temp.	*Mold temp.*	*Cycle time*	*Transparency*	*Surface*
°F.	°F.	sec.		
500	40	40	Excellent	Good
500	80	40	Very good	Good
500	120	40	Good	Good

Table II: Effect of mold temperature on physical properties

Cylinder temp.	Mold temp.	Minimum cycle	Stress-Strain Properties: Tensile strength[a]	Yield strength[a]	Elong.[a]	Stiffness[b]
°F.	°F.	sec.	p.s.i.	p.s.i.	%	p.s.i.
325	80	26	2400	1250	75	15,900
	160	45	1925	1000	80	11,900
500	80	34	2175	950	100	11,900
	160	67	1775	900	110	11,350

[a] A.S.T.M. D638-52T at 20 in./min.
[b] A.S.T.M. D747-50.

the mold temperature given was the temperature of the circulating water. Occasional checks of the actual mold temperature with a surface pyrometer gave numbers that were always within a few degrees of the water temperature.

Test specimen mold

The initial phase of the program was carried out with a four-cavity test specimen mold in the 4-oz. Reed. This mold is shown in Fig. 1, opposite. The mold surface was not highly polished. The four cavities are: a ½- by ½- by 5-in. heat-distortion bar; a ½- by ⅛- by 5-in. flexural test bar; a disk 2 in. in diameter and ⅛ in. thick; and a dog-bone tensile specimen ⅛ in. thick and 8.5 in. long. The total shot weight was 1.5 ounces.

A study of the effect of mold temperature on appearance was first carried out. A soft-flow material 1008.5 of MI = 23 was molded at a cylinder temperature of 500° F., 40-sec. cycle, and mold temperatures of 40, 80 and 120° F. The resulting specimens were then checked for transparency and surface. The results are shown in Table I, opposite. The transparency improves appreciably with lower mold temperatures and the surface appearance remains good. (The transparency was excellent as polyethylenes go but was quite cloudy in comparison to such transparent materials as polystyrenes and acrylics.) During molding, the mold surface temperature was found to be approximately the same as that of the circulating water. After viewing these moldings, we felt that a better looking molded piece resulted from the use of the 40° F. mold temperature. No change in appearance was noted after aging samples four days at 150° F.

After it was found that low mold temperatures could yield moldings of improved appearance, the effect of mold temperature on physical properties was studied. Test specimens were molded from the MI = 2 resin 1005, at cylinder temperatures of 325 and 500° F. and mold temperatures of 80 and 160° F. They were molded at the minimum cycle times consistent with good quality. These were shortest at the lower cylinder and mold temperatures, longest at the higher values. Clearly, the cooling time was the critical factor in determining cycle time, which is natural enough when molding a 1.5-oz. shot with a 4-oz. machine. For the same reason, the melt temperatures at the nozzle, as measured with a needle pyrometer, were very nearly equal to the cylinder temperatures for values up to 500° F.

The results are summarized in Table II, above, and are shown graphically in Figs. 2, 3, and 4. Tensile strength, yield point, and elongation were then determined according to ASTM D 638-52T, except that the strain rate was 20 in./min. which is consistent with the usual practice with polyethylene. Tensile modulus in flexure was measured using the ½- by ⅛- by 5-in. bar according to ASTM D 747-50. From these data, it appears that, at minimum cycle time, mold temperature affects the tensile, yield, and modulus, but it seems doubtful that the elongation is affected appreciably.[1] It is doubtful that the differences in cycle time had

(To page 154)

[1] Although none of the test runs made was completely duplicated, in the sense that the same procedure was repeated on different days with a shutdown between, great care was taken to give the machine time to reach a steady state. Moreover, groups of pieces from the same run gave test results agreeing within a few percent.

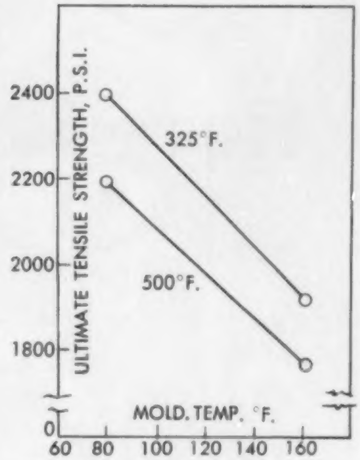


Fig. 2: Effect of mold temperature on tensile strength of low-density polyethylene

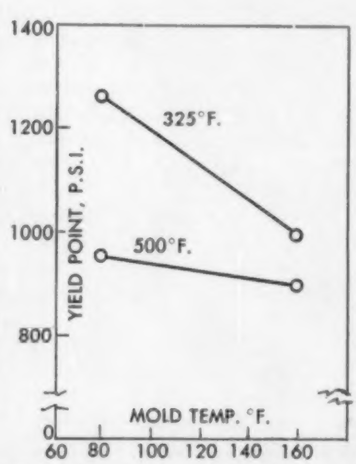


Fig. 3: Effect of mold temperature on yield point

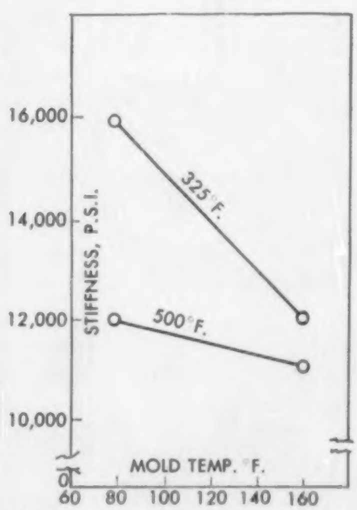


Fig. 4: Effect of mold temperature on stiffness

compression molding

most productive, most foolproof form

—the new Stokes Model 741 Presses incorporate exclusive design features to assure most economical output, highest dependability . . . available in capacities of 50, 75, 125 and 200 tons.

Check through the features that are built into the new Stokes Model 741 presses—and you'll see why they offer the most advanced concepts of fully automatic molding. They embody original design principles and operational refinements that are the result of Stokes pioneering experience in automatic molding:

Positive ejection system protects molds. Metal-to-metal contact between feed and comb, and scrape-off discharge independent of gravity are exclusive Stokes designs which prevent parts from falling back into the mold.

Pre-set loading board simplifies set-up. The feed board is initially set up as part of the tooling for each job. No need to make complex feed settings for each mold change. Complete changeover requires only about five minutes.

Fast press cycle gives high output. Feed board and comb move together . . . giving average dry cycle time of only 8 seconds.

The Model 741 feeds fast . . . presses fast (adjustable up to 27″/min.) . . . ejects fast; ideal for new fast-curing resins.

In-line design saves floor space . . . permits presses to be set up in batteries with all feed hoppers and discharge bins in two convenient rows.

Automatic sequence interlocks shut down the press if an interruption or double shot should occur.

The 741 has ample versatility to handle practically any molding job. The press provides either top or bottom ejection to suit the parts you're making. Automatic breathe is provided as standard equipment. Presses can be readily converted for direct feed from a pre-heating unit. The Stokes rope feeder is available for automatic feed of pre-mix rope from the spool. Flanged parts can be automatically molded by using side-draw split cavity molds.

Find out today how the new Stokes Model 741 presses can bring new economy and productivity to your molding operations, by writing for our new bulletin and for a consultation on your specific application.

Plastics Molding Equipment Division
F. J. STOKES CORPORATION
5529 Tabor Road, Philadelphia 20, Pa.

STOKES

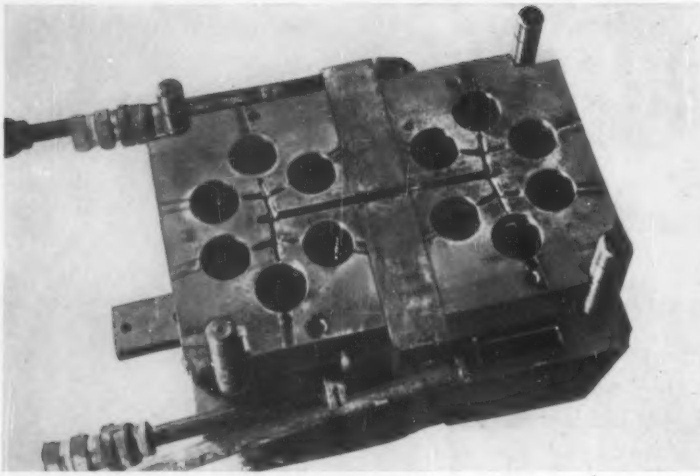


Fig. 5: Twelve-cavity mold, also run in a 4-oz. machine, was used for molding disks. Cavities were 1⅜ in. in diameter

an appreciable effect on melt temperature, since there was plasticating capacity to spare.

Figure 2 shows the relationship between mold temperature and tensile strength. The tensile strength may be seen to drop appreciably at the higher mold temperature at both cylinder temperatures. Here, raising the mold temperature 80° F. appears to have as great or greater influence than raising the cylinder temperature 175° F.

Figure 3 depicts the relation of yield point to mold temperature. Yield point decreased at the higher mold temperature although not to the same extent as did tensile strength. In this case a 175° F. rise in cylinder temperature exerted a more profound effect than the 80° F. increase in mold temperature.

Figure 4 exhibits the effect of mold temperature on stiffness. It appears that mold temperature exerted a pronounced effect on stiffness at the lower cylinder temperature but only a slight effect at the higher cylinder temperature. This is probably due to differences in the degree of orientation produced in the moldings under the different conditions.

Orientation depends on three basic factors: the viscosity of the entering melt, the filling rate, and the cooling time. The cooling time, in turn, is determined not only by material properties, but by the difference in temperature between the entering melt and the mold. At 325° F. the melt is relatively viscous, the shear stresses high, and freezing happens quickly, preserving the orientation. If the mold temperature is raised from 80 to 160° F., the cooling time is substantially increased and much of the orientation is dissipated by stress relaxation. At 500° F., on the other hand, the melt is perhaps one-fiftieth as viscous as at 325, so the flow-stress is very much smaller even though the filling rate is higher. Also, the cooling time has been greatly increased, and an 80° F. change in mold temperature makes less difference in cooling time and in piece properties. Much the same pattern appears in the other properties of Table II. It should be kept in mind that these properties were measured in the direction of flow and, therefore, of orientation. The gains made at the lower temperatures may be accompanied by reductions in properties in the other two directions.

Table III: Effect of mold temperature on molding of disks

Material	*Cylinder temp.*	*Mold temp.*	*Cycle*	*Transparency*[a]	*Surface*[a]
	°F.	*°F.*	*sec.*		
1007	350	60	28	4	12
MI=8		80	30	5	11
		120	38	8	10
	500	60	37	3	8
		80	40	4	6
		120	50	6	4
1008.5	350	60	27	2	5
MI=23		80	35	3	4
		120	45	5	3
	500	60	39	1	2
		80	55	1	2
		120	55	3	1

[a]Arbitrary rating—the lower the number, the better the property.

Twelve-cavity disk mold

Further work was then done using a 12-cavity disk mold, again in the 4-oz. Reed. The mold is shown in Fig. 5, above. The cavities were 1⅜ in. in diameter and had alternating 0.076-in. and 0.120-in. thicknesses. In this case, one side of each cavity was polished, the other side was not.

Poly-Eth 1007 and 1008.5 were molded at cylinder temperatures of 350 and 500° F. along with mold temperatures of 60, 80, and 120° F. Again the mold surface temperature appeared to follow closely the temperature of the circulating water.

Minimum cycle times consistent with quality moldings were determined and the parts examined for surface and transparency. The results are shown in Table III, left. In an attempt to evaluate more quantitatively the appearance of the moldings, numbers were assigned to each sample, placing each in a relative position both by transparency and by surface. The lower the number, the better the property. The high-melt-index material may be seen

in general to give better transparency and a better surface than the lower-melt-index material, as has usually been found. The previous observations on transparency were confirmed, with the transparency increasing at the lower mold temperatures, in each case. The transparency was poorer in the thicker sections, so comparisons were made only between parts of comparable thickness.

As pointed out before, this mold is rather unusual in that one side of the cavity is polished and the other is not. The side of the molding next to the polished side had a much higher surface gloss. On this side an increase in surface gloss was noticed in each case as the mold temperatures increased. On the unpolished side, however, no appreciable change was noted in the surface by varying mold temperature. An increase in cylinder temperature was also associated with improved transparency and surface. No change in appearance of the samples was noted after three weeks at 150° F.

Of great importance also are the relative minimum cycle times. The relationship of mold temperature to minimum cycle time is shown in Fig. 6, below. It is quite obvious that cycle times

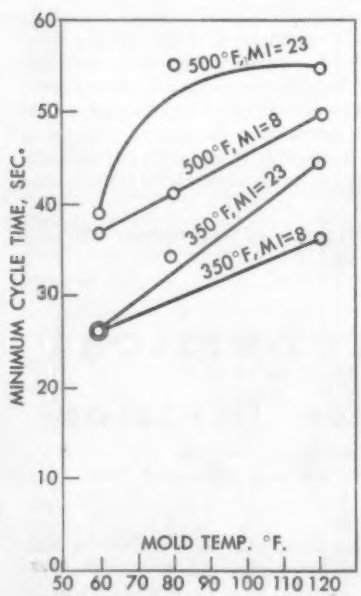


Fig. 6: Effect of mold temperature on cycle time in molding of disks

Fig. 7: Spiral-flow molds provide a means for measuring ease of flow of a plastic material in an actual molding machine

were reduced in all cases at the lower mold temperature. Naturally, higher cylinder heats required longer cycles. Also, the MI = 8 material gave slightly faster cycle times than the MI = 23 material at comparable temperature conditions.

At first glance it seems surprising that the higher-flow polymer requires the longer cycle, since the reverse is true in commercial molding. The joker is this: the comparison here was made on the basis of equal cylinder temperatures, whereas in commercial molding the higher-flow materials are normally molded at considerably lower cylinder temperatures. At the same temperature, the higher-flow material must be allowed more time to cool because of its lower heat-distortion temperature. If these two polymers had been molded at cylinder temperatures selected to equalize their flows, the material of MI = 23 would have been molded on a shorter cycle than the material of MI = 8.

Although no particular difficulty was encountered in achieving low actual mold surface temperatures, an important limitation in the use of cold molds was brought to light during this phase of the study. At the particular time this work was being performed, humidity conditions were such that 60° F. was the lowest temperature at which we could successfully operate because of the condensation of atmospheric moisture on the cavity surfaces. (If material is shot into a bedewed mold, ugly, rough moldings result.) An attempt to dry the surface and then keep it dry during the run with the hot material was unsuccessful under humid conditions.

Spiral test mold

One of the factors which certainly must be considered when studying the use of low mold temperatures is the resistance which the lower temperature offers to the flow of material in the mold. We have found that one of the most meaningful ways to measure the ease of flow of a plastic material in an injection molding operation is by use of an experimental spiral test mold, shown in Fig. 7, above. It consists of a ⅝- by 0.095-in. channel extending from the sprue for 60 in. in an oval-shaped spiral. In the operation of this mold, a given set of conditions of time, temperature, and pressure are established and the feed adjusted to give a uniform ⅛-in. cushion. After equilibrium conditions have been

Table IV: Effect of mold temperature on flow in spiral test mold

Material	Cylinder temp.	Mold temp.	Length of spiral At 5000 p.s.i.	At 10,000 p.s.i.	At 15,000 p.s.i.
	°F.	°F.	in.	in.	in.
1007	500	40	11.9	25.0	34.2
MI=8	500	90	12.5	26.5	35.5
	500	120	13.5	26.9	36.5
1008.5	500	40	18.7	34.7	46.0
MI=23	500	60	19.7	35.5	47.3
	500	90	20.1	37.5	48.4

established, sample shots are observed and the length of the spiral taken as a measure of the ease of flow at the given conditions. Here, also, we found that the mold surface temperature followed the water temperature quite closely.

Both 1007 and 1008.5 materials were run at cylinder temperatures of 500° F. on a 30-sec. cycle using mold temperatures from 40 to 120° F. At each condition the injection pressure was varied and the length of the spiral determined. The results are shown in Table IV and in Fig. 8, below. The higher MI material could not be run at 120° F. on this cycle. It is apparent that the best flow is obtained at the highest temperature.

The surprising thing is that the effect of mold temperature on flow is so slight. It is well known that in the melt state, flow is an exponential function of melt temperature[2] and, for polyethylene, the "apparent viscosity" is cut about in half for each 15 to 20° F. rise in its temperature. Here, however, an 80° F. rise in mold temperature increases flow not 16-fold, but merely 10 percent!

The obvious explanation is that the mold is filled so fast that, even though the temperature difference is about 400° F., the bulk of the melt cools very little during the period of flow. Flow stops when the tip of the flow front freezes and develops friction on the channel walls. Here again the cooling time is important, and the effect of mold temperature, on a percentage basis, would have been larger if the cylinder temperature had been lower—say 325° F.

Figure 8 shows also that a polymer of MI=8 under a pressure of 15,000 p.s.i. is very nearly equivalent in flow to one of MI=23 at 10,000 p.s.i. This is in good agreement with laboratory rheological data on polyethylenes, which show that flow rate is proportional to the MI and to a high power of the pressure.[2]

An important question, from the practical standpoint, is: How much must the pressure be raised to compensate for a drop in mold temperature? To answer this, the results of Table IV for the MI=8 materials have been replotted with pressure as the independent variable in Fig. 9, below. In this case, using 20 in. of flow as the reference point, it required an increase of 500 p.s.i. when the mold temperature was lowered from 120 to 90° F. and an additional increase of 300 p.s.i. when the temperature was lowered to 40° F. These pressure increases correspond to increases in the gage readings of 25 and 15 p.s.i., respectively; 25 p.s.i. is about the smallest change that can be detected with our gage.

Here again we encountered condensation of atmospheric moisture

(*To page* 160)

[2]Data on the melt flow of low-density polyethylenes have been reported by many workers; see, for example, "The Flow of Plastic Melts Through Dies," by J. P. Tordella; SPE J. 9, 6 (May 1953).

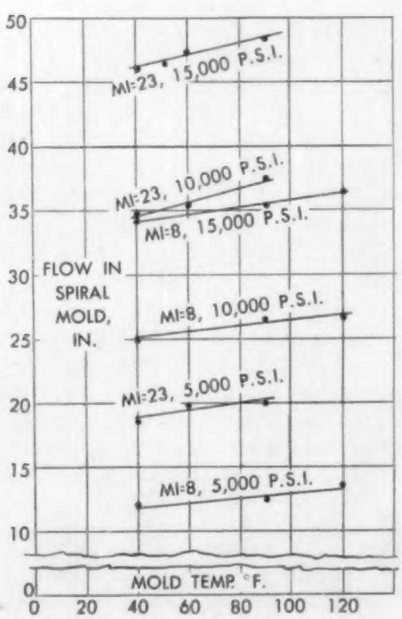


Fig. 8: Effect of mold temperature on inches of flow in the spiral mold is slight, but definite

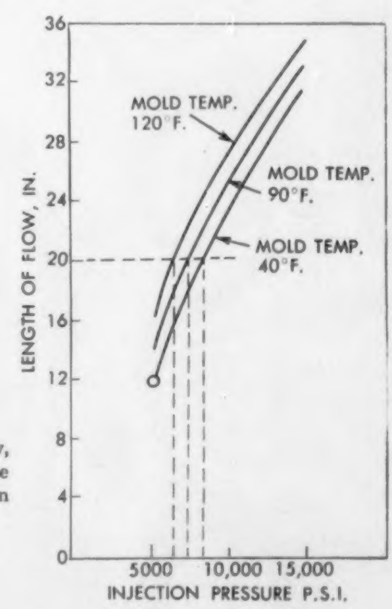


Fig. 9: In spiral flow, a 2000 p.s.i. pressure rise offsets an 80° F. drop in mold temperature

From wheels to heels...

TENITE BUTYRATE is characterized by extreme toughness, high impact strength, resilience, light weight, weather resistance, dimensional stability, lustrous surface...and an unlimited range of transparent, translucent, opaque, metallic and variegated colors plus crystal transparent.

Available in a wide variety of formulations to meet many different use requirements.

Adapted to the fastest injection molding, or continuous extrusion.

Typical uses: steering wheels, telephones, business machine keys, football helmets, oilers, tool handles, marine floats, oil-field and industrial pipe, toys, furniture parts.

from wraps to caps...

TENITE POLYETHYLENE is characterized by flexibility or semi-rigidity as desired, resistance to breakage, chemical inertness, excellent electrical properties, superior resistance to moisture vapor transmission, resistance to strong acids.

Available in the form of spherical pellets which flow freely in machine hopper...in natural or a wide variety of colors and color concentrates, with or without an antioxidant.

Adapted to rapid injection molding, blow molding, or continuous extrusion.

Typical uses: housewares, toys, packaging film, bottles, pipe and tubing, wire and cable insulation, paper coatings.

Fig. 10: Polyethylene dishpan mold is filled through a single gate in its bottom. Shot weighs 11.5 ounces

Table V: Effect of mold temperature on molding of dishpans

Cylinder temp.	*Mold temp.*	*Cycle time*	*Transparency*	*Surface*
°F.	*°F.*	*sec.*		
400	85	48	Poor	Poor
	120	70	Fair	Good
500	60	30	Good	Good
	85	63	Good	Good
	120	77	Good	Good

on the mold surface but in this case were able to keep it dry when on cycle. The only real difficulty was that extra care had to be taken to allow the mold to come to room temperature when shutting down to prevent rusting.

Dishpan mold

The final phase of this program was the investigation of the use of low mold temperatures for molding dishpans which might be considered representative of what would be expected when molding large housewares. The mold, very kindly loaned to us by the Wooster Rubber Co., of Wooster, Ohio, is shown in Fig. 10, above. The shot weight was 11.5 oz. in the 20-oz. HPM injection machine used.

All the moldings were made from 1008.5 material. However, in practice a resin of MI = 8 would be recommended for this job because of its superior stress-crack resistance. Cooling-water temperatures were varied from 60 to 120° F. and cylinder temperatures from 400 to 500° F. The 2-ton refrigeration unit used was unable to lower the water temperature below 60° F. (It is also of particular note that the temperature of the mold surface always ran over 140° F., no matter what the cooling water temperature was, thereby masking any beneficial effect of cold mold temperatures on appearance or properties.)

The results are shown in Table V, above. No difference was observed in the surface appearance except at the lowest cylinder and mold temperatures. Since this mold was not highly polished, this result confirms those obtained earlier with the disk mold (see Table III, p. 154). The transparency was improved at the higher cylinder temperature but was not affected by the mold temperature. At the lower cylinder temperature, the colder mold yielded a less transparent piece. The rougher surface quite likely contributed to this more opaque appearance.

The effect of mold temperature, or in this case, more properly, cooling-water temperature, on the minimum cycle time is shown in Fig. 11, below. As would be expected, faster cycles were obtained at the lower mold and cylinder temperatures.

Conclusions

The pros and cons of using cold molds are epitomized in Table VI, below.

We have seen that greater strength and stiffness might be expected by the use of cold mold

(*To page* 259)

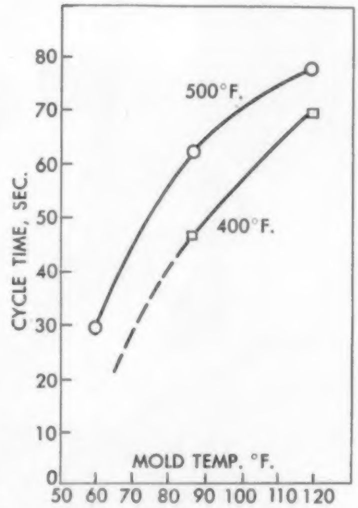


Fig. 11: Cycle time drops sharply with falling mold temperatures

Table VI: Factors resulting from using cold molds

Advantages

- Greater strength
- Greater stiffness
- Faster cycles
- Improve transparency

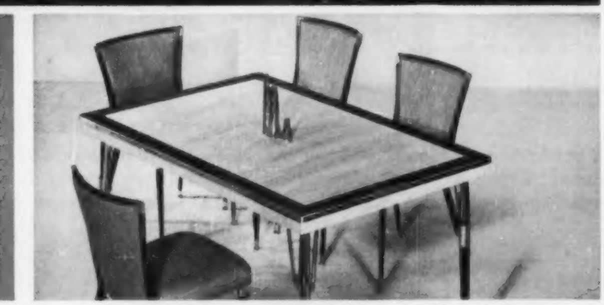
Limitations

- Decreased surface gloss
- Slightly greater resistance to flow
- Possible condensation of moisture on mold surface
- Requires efficient heat transfer in the mold
- Increased mold cooling costs

How to work up buying appetites

with Cyanamid Plastics and Resins

ELEGANCE WITH LONG-SERVING UTILITY. Designed by Brown & Bigelow, the attractive "Terrace Grill" barbecue set is molded of tough, hard-wearing, rich-looking CYMEL* Melamine Molding Compound. The CYMEL set resists heat, scratching and breaking, and will not chip or crack in normal household use. Molded-through color cannot fade or flake. CYMEL can be safely washed in an automatic dishwasher. Brown & Bigelow also has two other new premium products molded of heat-resistant CYMEL: the Smoke Ring nesting ashtrays and the Duo-Tray, a double playing card set that easily converts into an ashtray.



℞ FOR PRODUCT PROTECTION. For its Forthane* Inhaler cases, Eli Lilly & Co. uses BEETLE® Urea-Formaldehyde Molding Compound. BEETLE is odorless, is not affected by medicant ingredients, essential oils or many common solvents. Smooth, scratch-resistant and dust-repelling surfaces offer no easy foothold for bacteria. BEETLE resists staining and chipping, and offers an unlimited selection of permanent, molded-in colors. It provides good-looking, durable answers to many packaging problems.

ONE GLUE PROVED BEST by Douglas Furniture Corp. The world's largest producer of metal dining furniture finds that URAC® 185 Resin Adhesive eliminates "telegraphing" of the plywood grain to the surface of the plastic laminates used for table tops. Experience has proved conclusively to Douglas that no other glue can cut down rejects and provide such complaint-free service as URAC 185. This urea adhesive may be used with equal dependability in laminate, plywood and lumber core gluing.

Nothing whets buyers' appetites like the good looks and reliable performance of *quality* products...which are yours when you use Cyanamid melamine and urea molding compounds, polyester resins, resin adhesives and resins for surface coatings.

*Trademark

CYANAMID

AMERICAN CYANAMID COMPANY
PLASTICS AND RESINS DIVISION
32 Rockefeller Plaza, New York 20, N. Y.

IN CANADA: North American Cyanamid Limited, Toronto and Montreal
OFFICES IN:
Boston • Charlotte • Chicago • Cincinnati • Cleveland • Dallas • Detroit
Los Angeles • New York • Oakland • Philadelphia • St. Louis • Seattle

Vacuum venting of molds

In a new approach to trapped-air problems, a vacuum pump exhausts the mold cavities just prior to injection

*By George S. Bohannon**

One of the many stubborn and costly problems that has plagued the injection molding industry since its beginning is that of trapped air in mold cavities. Because of this problem, product design suffers considerable limitation; certain general design shapes are such that flow of material into the mold cavity seals off vents long before the cavity is filled. Compression of the air trapped ahead of the inflowing melt will result in a burn, void, or poor weld at the point that is reached last by the melt.

When such defects show, it is customary to try one or more corrective measures before abandoning the original design. Among these attempts are: change of gate location, addition of vents and dummy ejector pins, additional webs or ribs within the part, and alteration of wall section to change the flow pattern. These corrective measures are usually expensive and often ineffective.

*Bohannon Industries, 702 S. Cascade Ave., Colorado Springs, Colo.

Exhaust air before injection

There is only one sure cure for trapped air: get the air out of the cavities before injecting the melt. Much thought has been given to this idea and many types of "improvisations" have worked well on certain jobs. There are a number of patents covering the various techniques employed for air exhaustion but these patents usually pertain to a particular technique developed to solve a particular problem. Something more generally applicable is needed.

The technique given here is rather simple, and is based on a phenomenon long observed in the industry.[1] This phenomenon is observed in molds where vents are projected from the cavity across the mold face into the outside atmosphere. Ordinarily these vents consist of a channel of convenient width and very slight depth. They form, in the mold-closed position, a thin, slit-shaped orifice leading from the cavity to outside air. In practice it is customary to place the orifice as nearly as possible opposite the gate, where—it is hoped!—the last bit of filling occurs. When material flows into and fills the cavity vented by an orifice, air flows freely through the orifice, but the viscous melt will not go far into the thin, cold slit before solidifying. It is on these slit-flow characteristics of air and plastics that the present scheme is based. All that is needed is a mold with adequate and conveniently located venting orifices suitably connected to a vacuum pump.

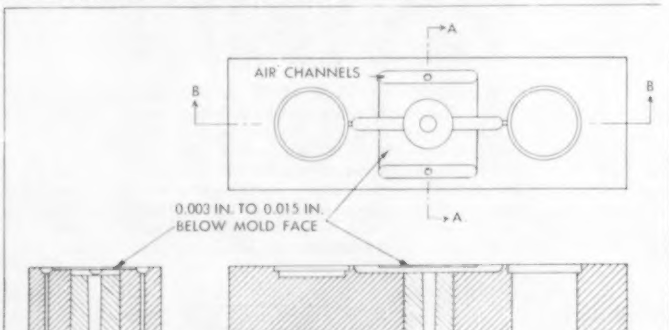
[1]To the author's knowledge, no part of the present proposal has been claimed in an issued patent; but he assumes no responsibility for infringements resulting from commercial use of the technique described here.

Mechanical details

Figure 1 is a drawing of the female half of a two-cavity stripper-plate mold, conventional in every respect, except for the venting orifices. On the mold face, and in convenient relation to the runners, are machined two air channels, and between these and the runners are machined shallow recesses, which form orifices when the mold is closed.

With the mold closed, the nozzle in contact, and the vacuum pump operating, air is drawn from the cavities, gates, sprue and runners through the orifices and into the vacuum line. Then, when material is injected into the mold, there is no air to be trapped. Some flash of material into the venting orifices may occur, but as long as the material solidifies before going into the air channels, all is well. Flash into the orifices remains connected to the runners and is ejected with the molded parts, leaving the orifices clean

Fig. 1: Sketch of vacuum-vented mold. At top is view looking at face of female half of mold. Section BB show details of cavities in which a small cylindrical container and its snap-on cover are molded. Section AA shows vacuum-venting details



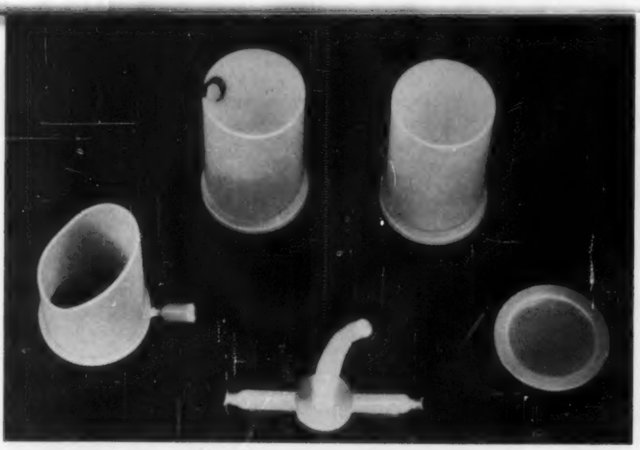


Fig. 2: Pieces made in mold illustrated in Fig. 1. At lower left is a short shot that shows general pattern of filling. At top left is a container made in the unexhausted mold. It failed to fill completely and compression of the air ahead of the melt burned the edge as it reached the top. Top right and lower right are perfect pieces made in vacuum-vented mold. Bottom center is sprue and runners with 0.085-in. wide edges

for the next cycle. Note that by venting from the runners instead of from the cavities, the problem of trimming vent flash from molded parts is avoided.

Adaptability

This technique is quite generally applicable. Orifice vents may be located in contact with any runners or extended runners anywhere within the limits of the mold face, or they may be connected with the mold cavities where conditions are crowded and flash trimming is tolerable.

The vacuum equipment need not be elaborate. It should consist of a ¼- or ½-hp. pump displacing about 5 cu.ft./min. and drawing down to ¼ in. Hg abs. or better; an electric timer with range from 0 to 15 sec.; a solenoid-operated air valve; and miscellaneous hose and fittings. An accumulator in the vacuum system is optional but usually unnecessary.

The electric timer delays the injection stroke a few seconds while the solenoid valve is opened and air is drawn from the mold. Then when this timer has run out, injection begins.

Time required for adequate exhaustion depends upon pump efficiency, cavity volume, orifice dimensions, and the degree of exhaustion required. Some typical data on exhausting time are given in Table I. These experiments were made with an orifice measuring 0.005 by 0.5 by 2 in., and a pump having a displacement of 5 cu.ft./min., all connections being made with 0.25-in. tubing.

In the mold shown in Fig. 1, the orifice depth was 6 mils. This mold was run in a machine having a preplasticator, filling it with high-impact polystyrene at 450° F. at a rapid injection rate, with 10,000 p.s.i. at the nozzle. The mold temperature was 120° F. Under these conditions, the flash travel into the slit was consistently found to be 0.085 inch. Exhausting time needed to prevent air-burning in the bottom of the deep cavity was 0.6 second. In previous experiments with the same conditions, but with a slit depth of 3 mils, the time needed was 1.5 sec., but there was no visible flash into the vents.

Note that the deep cavity in Fig. 1 has a heavy flange around the top at the parting line. This heavy portion fills first and traps air in the lower portion of the cavity. Because of this condition, it is impossible to mold this particular part without vacuum-venting the cavity (see Fig. 2).

The slit width (perpendicular to flow) should be as large as is consistent with available space on the mold face, but the depth and length (parallel to flow) must be chosen with due consideration of the flow characteristics of the material being molded. For instance, if the mold is to be filled with nylon at high pressure, and is run "hot," the slit depth may not safely exceed 2 or 3 mils for a length of 0.5 inch. With a more viscous material and/or at a lower mold temperature, the orifice may be proportioned with a depth of 5 to 10 mils and a length of 0.3 to 0.5 inch. The deeper, wider, and shorter the slit, the more rapid will be the venting; but it must not be so low in resistance to flow that the material squeezes all the way through and into the vacuum line.

For assured operation it is necessary that the mold be essentially air tight. It is required that the nozzle be in good contact, the mold faces be parallel with good finish, and ejector pins fitted with "O" rings or other good seals. Any previous vent passages to the outside must be blocked off.

The cost of the finished mold, including orifices, vacuum connections, etc., (but not the pump) should not exceed an increase of 10% above that of a conventional mold.

Table I: Time to evacuate various mold cavities

Capacity of cavity	*Time*	*Absolute pressure*
oz. polystyrene	*sec.*	*in. Hg*
3.5	1.5	2.1
	3	1.6
	6	0.1
8	1.5	3.3
	3	2.1
	6	0.9
16	1.5	7.1
	3	4.6
	6	2.6

Conclusions

It is likely that many molds have been junked that might have been saved by vacuum-venting.

Vacuum venting can usually be accomplished from the runner system, so that no "vent flash" is left on the piece. Vent slit dimensions must be chosen to reach a balance between speed of venting and amount of flash.

The cost of the necessary equipment for a complete mold exhaust system is small in comparison with the cost of building just one mold that doesn't work.

Investigation of plastics for toilet bowls

By S. B. Swenson and H. Graus**

Reinforced plastics offer many advantages of strength and weight over ceramics as materials from which to make toilet bowls. The odor retention of candidate plastics has been measured and several were found to be satisfactory in this respect. On a large-scale basis, plastic toilets should be able to compete costwise with ceramics, even in places where the saving in weight is not important. A sample toilet, a reproduction of a ceramic model, was easily made by ordinary methods for molding reinforced plastics.

In developing sanitary equipment for prefabricated buildings, Army engineers have turned to plastics as a possible answer to military requirements for low-volume production of low cost, lightweight, non-corrodible, non-breakable fixtures.[1]

Investigation of plastics in this new role was begun after studies of existing fixtures indicated that standard items in cast iron and ceramics were too heavy and bulky, and highly subject to damage and breakage. Stainless steel fixtures used by the Navy were found to be lightweight but expensive. It was also recognized that steel, particularly stainless steels, would be critical in wartime.

A review of the entire field of available materials indicated that plastics possessed most and perhaps all of the necessary characteristics. These include low cost, high strength/weight ratios, and good color retention. An ideal material should also be corrosion resistant, non-breakable, non-combustible, and should not retain odors.

The first test made was an evaluation of the odor retention of six plastic materials: alkyd, methyl methacrylate, polyester resin reinforced with glass fibers, rigid vinyl chloride-acetate copolymer, diallyl phthalate polymer reinforced with glass fibers, and asbestos-filled phenol-formaldehyde resin. Two 2 by ½ by ⅛-in. samples of each material were placed in a 500-ml. round-bottom flask connected to a 16-in., water-cooled, reflux condenser. The flask was charged with approximately 250 ml. of urine. The contents were refluxed for 2 hr. at the boiling point of the liquid. At the end of the 2-hr. period the samples were removed and quickly washed twice in approximately 300 ml. of water before they were evaluated by noting their odors. The results of the tests are listed in Table I, opposite.

After the olfactory examination, the samples were placed in a 500-ml. beaker of water and allowed to stand overnight. When tested the following morning none of the samples had any detectable odor. No noticeable changes in the appearance of the specimens were noted, except in the case of the rigid vinyl chloride-acetate copolymer which changed to a milky-white, opaque color from its original transparent, pinkish tint.

The effects on a plastic material of 2-hr. contact with boiling water, or a boiling dilute aqueous solution of a salt, acid, or alkali may be considered roughly equivalent to immersing the material in the liquid for three

Fig. 1: Components of reinforced plastics toilet

Fig. 2: Cast epoxy mold for one-half of the inside bowl-and-trap section

*Corps of Engineers' Research and Development Laboratories, Fort Belvoir, Va.
[1]See also "'All-plastics' interior," MODERN PLASTICS 34, 110 (Sept. 1956) for a description of a one-piece reinforced plastics lavatory made by the Budd Co. for the "Pioneer III" railroad car.

Fig. 3: Epoxy mold for exterior commode body (right) was cast on ceramic toilet bowl

Fig. 4: Mold for bottom part of toilet (foreground) was also produced from cast epoxy resin

weeks at room temperature. Also, the urine was used full-strength in the test whereas in practice the bowl would contain enough water to dilute it to a small fraction of its original concentration. Hence, it may be considered that most of the samples tested showed high resistance to absorption of urine. However, since only reinforced plastics have the impact strength and rigidity required for sanitary utility applications, only the diallyl phthalate and polyester resins reinforced with glass fibers could be considered. This does not exclude the possibility that alkyd might be satisfactory if it were reinforced.

On the basis of these results, the second step was undertaken and five fibrous glass reinforced polyester samples averaging 0.9 in. in width and 0.25 in. in thickness were tested for flexural strength. Each sample was placed on knife edges 4 in. apart with the load applied vertically in the center. The average stress (outermost fiber) at failure was 21,000 p.s.i. This strength was ample for sanitary utility applications.

As the next step, with the cooperation of one of the leading sanitary fixture makers, two ceramic toilet bowls were procured. One was cut through the line of symmetry with an abrasive wheel to produce two identical halves. These were then studied thoroughly in deciding the procedure necessary to fabricate a duplicate in plastic.

To build such a bowl of reinforced plastic required some changes in the design of the bowl. The major departure consisted of three-piece construction, instead of the one-piece construction of the ceramic bowl. The three parts were the shell, the bowl proper, and the foot. Figure 1, opposite, shows these components ready for assembly.

The two symmetrical halves of the ceramic bowl were first used to cast molds of the inside bowl-and-trap sections in epoxy resin (Fig. 2, opposite) and from each of these molds, a polyester laminate casting was made using glass cloth and polyester-bonded glass mat for reinforcement. The surface was finished with a white gel coat. These castings (and all the others) had wall thicknesses of about ⅛ inch.

In a similar manner, but using the intact second ceramic commode, an epoxy mold was made of the exterior body (Fig. 3, above) and also of the bottom (Fig. 4, above). Castings were then made from these molds in reinforced polyester, following the same procedure that was used in making the bowl.

The components were fitted together, all necessary holes were drilled, and then they were assembled by using a paste made up of epoxy resin and milled glass fiber. All exterior joints were feathered and blended into the surface, using white poly-

(*To page* 260)

Fig. 5: Finished reinforced plastics toilet bowl, fitted with plastic seat

Table I: Odor retention of various plastics

Material	*Immediate olfactory test*
Alkyd	no odor
Methyl methacrylate	no odor
Polyester resin reinforced with glass fibers	very slight odor
Rigid vinyl chloride-acetate copolymer	very slight odor
Diallyl phthalate polymer reinforced with glass fibers	very slight odor
Phenol-formaldehyde filled with asbestos fibers	slight odor

Economical annealing oven

Conveyorized oven saves floor space, conserves heat

An improved acrylic annealing oven, recently designed and built by Douglas Aircraft Co. engineers, offers many advantages over conventional ovens used to anneal large acrylic parts. They are: 1) smaller floor area for a given annealing production rate, 2) ease of loading and unloading, 3) reduced heat losses while parts are being loaded or unloaded, 4) automatic and close control of temperature and annealing time, and 5) the impossibility of accidentally removing parts from the oven before they have gone through the full annealing cycle.

The heart of the new oven is an endless vertical conveyor that resembles a Ferris wheel. Seven freely suspended double platforms are mounted on a driven conveyor chain. The platforms are made of angle iron and heavy steel screen. A sketch of the oven, which is 16 ft. long, 10 ft. wide, and 18 ft. high, is given in Fig. 1. In operation, the platforms are unloaded and loaded one at a time (Fig. 2) as they appear before twin sliding doors that provide access to the oven at a convenient level for handling. After a platform is loaded, and starts its circuit within the oven, it is not available again until it has completed the circuit and reappears at the loading doors. Thus it cannot inadvertently be unloaded too soon.

The speed at which the chain drive carries the platform is adjustable, and is set so that a single circuit is just long enough to completely anneal the parts. Annealing is accomplished by electrically heated air that is circulated in the oven by blowers.

Although this oven is at present being used only for annealing acrylic canopy components, the same principle should serve well in drying and curing ovens, with appropriate modifications of the platforms and size.

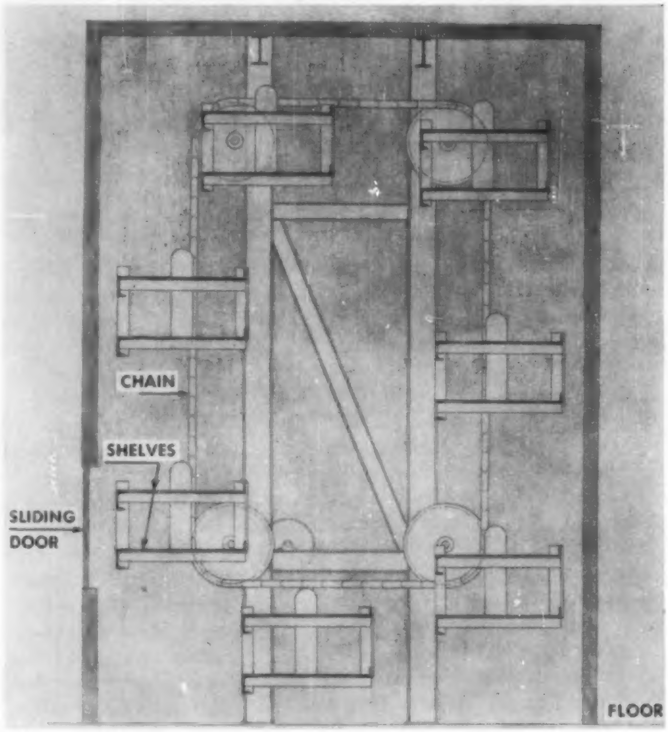


Fig. 1: Schematic drawing of new acrylic annealing oven. Note oven height in relation to floor space required

Fig. 2: Acrylic airplane canopy components are loaded into annealing oven. The twin sliding access doors reduce oven heat losses while loading or unloading, since not more than half the aperture is open at any time. (Illustrations, Douglas Aircraft)

Table I: Comparative prices of monomers

the tertiary C-
atoms, relative to

asymmetric C-atoms are absent.
In molecules of finite chain length

Dr. Gordon M. Kline, Technical Editor

Stereospecific catalysis and isotactic polymers

By G. Natta[†]

Stereospecific polymerizations are highly interesting from a theoretical point of view as well as from important practical applications. Even now, certain stereoisomeric polymers have entered into various fields, e.g., those of plastics, textile fibers, and synthetic rubber. Crystalline polymers of high melting point are obtainable from very cheap olefins (propylene, butylene); there is a new class of thermoplastic materials of low density, high mechanical strength, low price, and versatile applications.

Certain isotactic polymers with melting points between 160° and 300° C. are of special interest for fibers and transparent films, while in the field of plastics greatest interest attaches to polypropylene, whose properties exceed in many ways those of polyethylene.

In the field of diolefins, crystalline polymers of isoprene are now obtainable by stereospecific polymerization, having the same 1,4-trans structure as natural gutta percha; also, a synthetic rubber can be prepared consisting of macromolecules in which the majority of monomer units are sterically identical to those of natural rubber.

The possibilities of stereospecific catalysts do not appear to be limited to polymers of olefins and diolefins.

A new chapter of polymerization has recently been opened (1-15)[1], of considerable theoretical as well as practical interest, i.e., stereospecific polymerizations. It is closely linked with the use of catalysts capable of determining the appearance of well defined, ordered steric configurations of the monomer units in the polymeric chain and the tertiary carbon atoms therein contained during the process of polymerization.

The different stereoisomeric polymers, derived from the same monomer, have widely diverging physical properties (melting point, crystallinity, mechanical behavior, etc.); therefore, stereoisomery causes far more conspicuous effects in macromolecular substances than it does in the case of low-molecular-weight materials.

Types of polymerizations

There are two types of stereospecific polymerizations, according to whether the monomers show stereoisomerism themselves or not.

In the first case (i.e., monomeric stereoisomers) a stereospecific influence can direct selectively the reaction of molecules of both steric configurations in such a way that the newly formed molecules contain the pre-existent stereoisomers in a fixed arrangement.

A catalyst of this type would have to contain agents selective for one or the other stereoisomer to give molecules each formed by the polymerization of molecules with the same steric configuration. Such a type of stereospecific polymerization accounts for the high melting point of the polypropylene oxide obtained by Price (16) under special conditions, starting with a racemic mixture. These polymers are crystalline, optically inactive, and have a melting point as high as that of polymers prepared from optically active monomer. In the usual process (using alkali hydroxide or

*Reg. U. S. Pat. Off.
Condensed from a lecture given on April 25, 1956, at a meeting of the Plastics and Polymer Group of the German Chemical Society at Bad Nauheim, Germany, and published in Angewandte Chemie, June 21, 1956, pages 393-403. Translation made available through the courtesy of P. O. Lenel and J. W. C. Crawford, I.C.I. Ltd.

†This paper interprets experimental results in the synthesis of stereospecific polymers, obtained at the Institute of Industrial Chemistry at the Milan Polytechnic. The principal collaborators were: P. Pino for the organic-chemical part; G. Mazzanti, L. Porri, G. dall'Asta, and P. Longi for the polymerization and fractionation work; O. Corradini and I. Bassi for the crystallographic investigations; F. Danusso and G. Moraglio for physico-chemical measurements; E. Mantica, M. Peraldo, and D. Morero for infra-red spectra; M. Fanua, I. Pasquon, and E. Goachetti for kinetic measurements, and G. Crespi for mechanical properties.
[1]Numbers in parentheses link to references at end of article, p. 263

Table I: Comparative prices of monomers

Polymer	*Raw material*	*Price*
		cents/lb.
Polypropylene	Propylene (mixed with propane)	2 to 3
Polybutene	Butene-1 (enriched)	5
Polystyrene	Styrene	16.0
Polybutadiene	Butadiene	15.0
Nylon	Adipic acid	35.0
Terylene	68% terephthalic acid	35.0
	32% ethylene glycol	13.5

alkoxides) the racemic monomer gives amorphous low-melting polymers.

Stereoisomerism in vinyl compounds

The stereospecific polymerization of vinyl compounds of the type $CH_2 = CHR$, not usually showing stereoisomery in the monomeric state, is far more important (Table I, above). By means of stereospecific catalysts, the polymerization can be directed to a completely ordered association of monomer units in the growing macromolecule, giving regular sequences or alternations of definite steric configurations.

A molecule, obtained by polymerization of a vinyl monomer, contains at least (n — 2) tertiary C-atoms. Some of them, those near the ends of the chain, are typical asymmetric carbon atoms; the constitution of the substituent groups is so different that true optical isomerism can occur.

With very high polymers, the influence of the end groups on the chemical and physical properties of the macromolecule becomes negligible, not excluding the optical properties. Thus, if the substituent R in a monomer $CH_2 = CHR$ has itself no optical isomerism, infinitely long polymeric chains should not show optical isomerism either. The optical activity, caused by an asymmetric carbon atom, depends on the constitutional differences in those parts of the substituents near to that atom; these near regions are obviously identical in polymerized $CH_2 = CHR$- compounds.

However, a special type of stereoisomerism now arises, depending only on the configurations of the tertiary C-atoms, relative to one another. This type of isomerism is easily understood by projecting the paraffinic zig-zag chain in a plane (Fig. 1, below). Different types of configurations of the tertiary C-atoms are possible, according to the relative positions of the groups *R*. The *isotactic* structure is defined by the arrangement of all the groups *R* on the same side of the plane of the main chain (all above or all below) (1, 4, 6, 8, and 9).

In the *syndyotactic* structure, the groups *R* alternate above and below the main chain (8, 9, and 11). In *atactic* structures the groups *R* are arranged irregularly above and below the chain. However, in reality the configurations of all tertiary carbon atoms become identical only in infinitely long chains of isotactical polymer; in such a case, optically active asymmetric C-atoms are absent. In molecules of finite chain length with different end groups, the optical activity can be predicted to be very small and is compensated in solution by the presence of enantiomorphic macromolecules.

In polymers of irregular structure, one tertiary C-atom differs from the next one according to the relative configurations. In atactic polymers, with statistical distribution of the opposite sterical configurations, both intra- and intermolecular compensations occur.

The polymerization of a vinyl monomer *A* (potentially showing stereoisomerism when a member of a polymer chain) by means of an ionic initiator *BH*, leads to the types of stereospecific polymers shown in Formula 1, p. 172.

In the anionic polymerization of vinyl compounds, initiated by recycle of dissociated and regenerated catalyst or by chain transfer with the monomer, the types of stereospecific polymerization shown in Formula 2, p. 172, can occur.

In short, the following head-to-

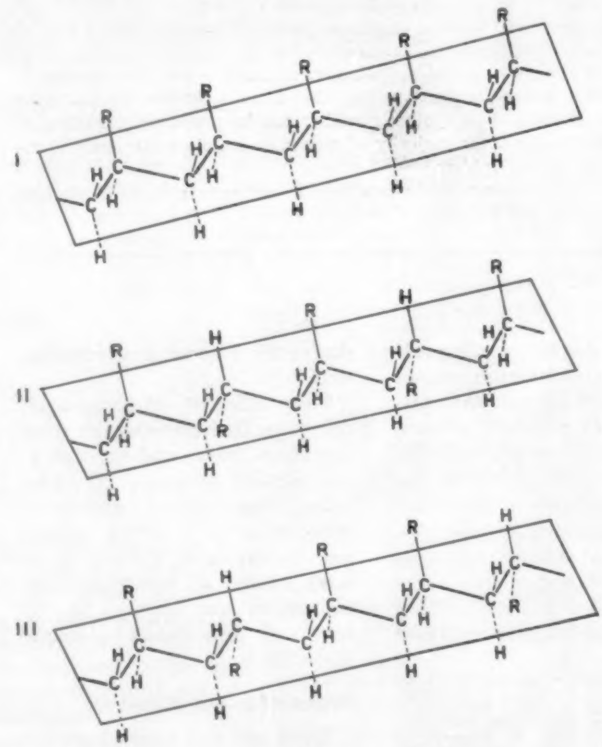
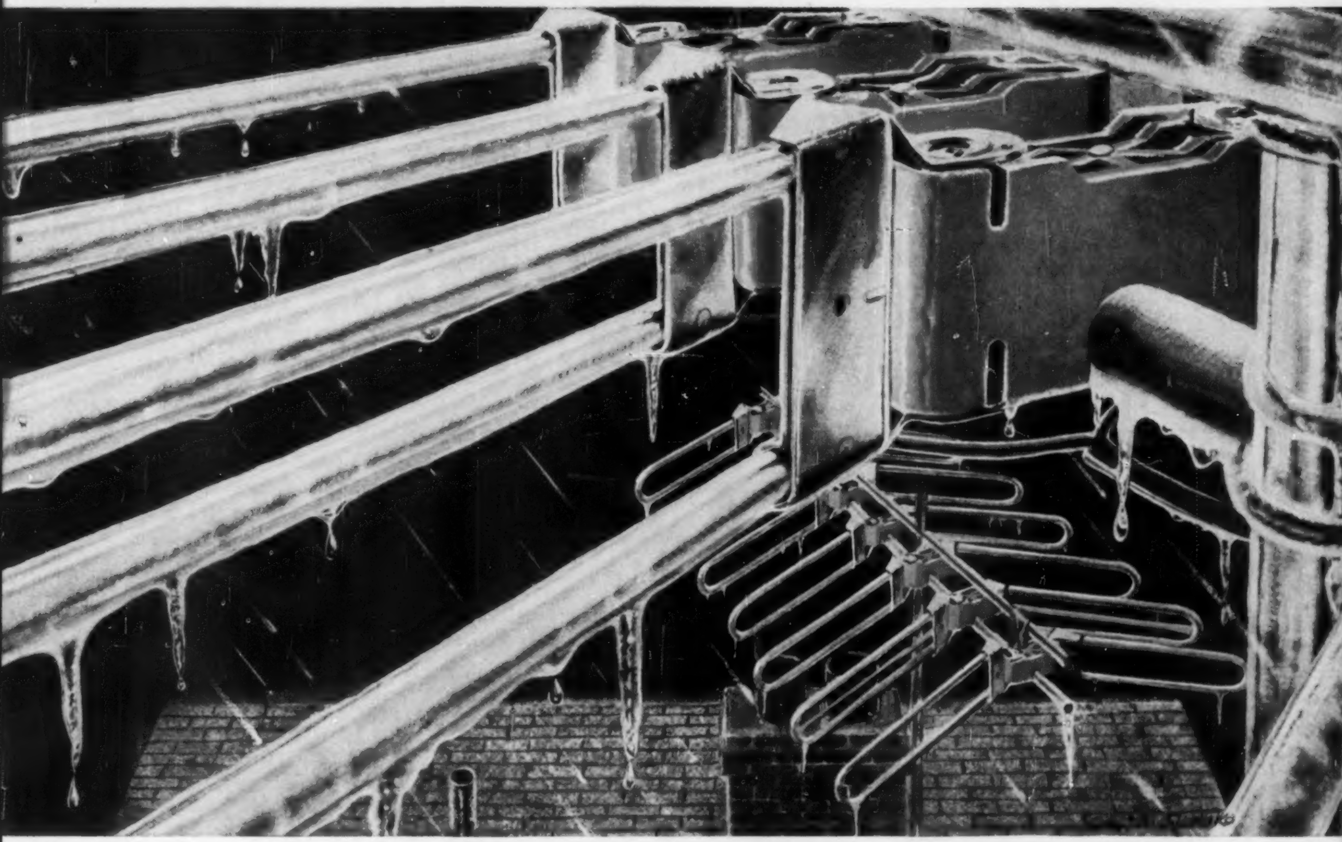


Fig. 1: Code to numerals is as follows: I—isotactic; II—syndyotactic; and III—atactic

Naugatuck KRALASTIC



THE POWERFUL CHANNEL MASTER T-W, WITH EXCLUSIVE "TRAVELING-WAVE" DESIGN, MANUFACTURED BY CHANNEL MASTER CORP., ELLENVILLE, N.Y.

CHANNEL MASTER

world's largest manufacturer of TV antennas

switched to KRALASTIC

Why?... because outdoor weathering is really rugged and TV antennas have to stand up to ice, heat, wind and continued vibrations 24 hours a day, season after season. Besides being a non-conductor that cannot rust, rot, or corrode, KRALASTIC® proved to have seven times more strength than the leading competitive plastic. Molded KRALASTIC brackets, in combination with a new double-truss construction developed by Channel Master, insure double-strength antennas.

Naugatuck's KRALASTIC (an acrylonitrile copolymer) rubber-resin blend provides end products with hardness and toughness, high dimensional stability and reliable performance, over a wide temperature range. KRALASTIC is resistant to most chemicals, and less than half the weight of aluminum.

Used for self-lubricating wheels, pulleys and window channels, for tote boxes, combs and camera cases, KRALASTIC is proving its superiority over wood, steel, and other plastic resins. Why not consider the many opportunities KRALASTIC offers you to increase sales potential and improve product performance? We'll be glad to send you any information you may need... just write us on your company letterhead. Better do it today!

United States Rubber

Naugatuck Chemical Division

Naugatuck, Connecticut

BRANCHES: Akron • Boston • Gastonia, N.C. • Chicago • Los Angeles • Memphis • New York • Phila.
IN CANADA: Naugatuck Chemicals, Elmira, Ontario • Rubber Chemicals • Synthetic Rubber • Plastics • Agricultural Chemicals • Reclaimed Rubber • Latices • Cable Address: Rubexport, N.Y.

$$BH + mA = B(A^{*l,d})_{m-1}\ AH \qquad \text{atactic structure}$$

$$BH + mA = B(A^{*iso})_{m-1}\ AH \qquad \text{isotactic structure}$$

$$BH + 2mA = B(A^{*l}A^{*d})_{m-0.5}\ AH \qquad \text{syndyotactic structure}$$

FORMULA 1

$$(n+2)\ CHR{=}CH_2 \rightarrow (CH_2{=}CR)\ (H_2C \cdot HRC^{*d,l})_n\ (CH_2 \cdot CH_2R) \qquad \text{atactic}$$

$$(n+2)\ CHR{=}CH_2 \rightarrow (CH_2{=}CR)\ (H_2C \cdot RHC^{*iso})_n\ (CH_2 \cdot CH_2R) \qquad \text{isotactic}$$

$$(n+2)\ CHR{=}CH_2 \rightarrow (CH_2{=}CR)\ (H_2C \cdot RHC^{*d} \cdot H_2C \cdot RHC^{*l})_n\ (CH_2 \cdot CH_2R) \qquad \text{syndyotactic.}$$

FORMULA 2

tail linear polymers can be obtained from α-olefins with a simple regular structure $CH_2 = CHR$ (with *R* an aliphatic or aromatic substituent with no possibility of stereoisomerism):

1) Isotactic polymers, consisting of chain segments, characterized by a regular recurrence of monomer units whose tertiary C-atoms are all of the same steric configuration.

2) Syndyotactic polymers, consisting of a regular sequence of monomer units, every second of which has the opposite configuration.

Further, head-to-tail linked linear vinyl polymers do exist with more or less irregular structures: atactic polymers, characterized by the absence of any regular distribution of configurations; and block-homopolymers, comprising various types with different physical properties, according to the prevalence of one or the other type of block and to the dimensions of the respective segments, e.g., isotactic-atactic types and syndyotactic-atactic types, both containing regular and disordered segments, respectively.

The difference in properties of the various polymers is considerable if the substituent *R* has much larger dimensions than a hydrogen atom, a fluoride atom, or a hydroxyl group. The atactic polymers then are amorphous, noncrystallizable even at low temperatures, and have a low softening temperature (2nd order transition) (Table II, right).

Free radical polymerizations usually lead to atactic polymers; where a tendency to ordered structures appears, this is due to an increased probability of a syndyotactic over an isotactic arrangement (8, 9). Completely isotactic or syndyotactic polymers generally show high melting points, high crystallinity, and good mechanical properties (Table III, p. 174).

The structure of some isotactic α-olefin polymer chains, polypropylene (1, 2), polybutene-1 (7), and polystyrene (3, 6), has been described previously; these chains were found to have a threefold symmetry and an identity period of 6.5A, based on a helical structure with three monomer units in each helix. Using Bunn's nomenclature (17) this structure embodies the type $(AB)_3$. Later results (12-14) showed that monomers with branched side-chains (methyl branches) still form crystalline isotactic polymers, with higher melting points than the corresponding polymers of linear monomers (Table IV, p. 174); the former also have helical structures in the crystalline state, but with different size of the helix and different numbers of monomer units per complete turn of the helix.

Crystalline polymers have been obtained by polymerizing racemic mixtures of monomers, containing an asymmetric C-atom, e.g. 4-methyl hexene. These polymers are isotactic, i.e., of regular structure, as far as the C-atoms of the main chain are concerned.

However, the carbon atoms of

Table II: Comparison of linear, isotactic, and non-isotactic polymers obtained by anionic polymerization

Polymer	*Density*	*Transition temp.*	*Identity period along the fiber axis c in A*	*No. of monomer units in identity period*
	g./cm.³	*°C.*		
Polypropylene				
Isotactic	0.92	160 to 170 I Order	6.50	3
Atactic	0.85	—35 II ”	—	—
Polybutene-1				
Isotactic I	0.91	126 to 128 I ”	6.45	3
Isotactic II	—	—	6.85	4
Atactic	0.87	—45 II ”	—	—
Polypentene-1	0.87	75 to 80 I ”	6.60	—
Poly-3-methyl-butene-1	0.90	245 I ”	6.84	4
Poly-4-methyl-pentene-1	0.83	205 I ”	13.85	7
Poly-4-methyl-hexene-1	0.86	188 I ”	14.0	7
Poly-5-methyl-hexene-1	0.85	130 I ”	6.50	3
Polystyrene Isotactic	1.08	230 I ”	6.65	3
Polystyrene Atactic	1.05	85 II ”	—	—

Table III: Properties of stereospecific, non-oriented polymers

Polymer	*MW*	*Yield point*	*Yield strength*	*Elongation at break*	*Vicat soft. pt. (1 kg.)*
		kg./cm.^{2}	*kg./cm.*^{2}	%	°C.
Polypropylene	350,000	290 to 310	420 to 440	750 to 800	150
Polypropylene	100,000	320 to 340	400 to 420	650 to 700	150
Polybutene-1	60,000	—	200 to 220	350 to 400	99
Polypentene	45,000	—	120 to 150	450 to 500	—

the side chain, in a polymer with isotactic main chain, can give rise to further stereoisomers according to the configurations *d* or *l* in the side chain, arranged all *d* or all *l*, or alternating, or with statistical distribution. The fairly high solubility and the not very clear X-ray diagrams of our isotactic poly-4-methyl-hexene-1 points to the last-named type of structure as the most probable, in spite of a relatively high melting point and high crystallinity.

Polypropylene oxide

As soon as Price's results on the polymerization of propylene oxide became known, we investigated their structure to see whether these crystalline polypropylene oxides showed any analogies to isotactic polymers. Samples prepared according to Price and the Dow Co. (16, 18) gave fiber diagrams that led to a unit cell with a = 10.60A, b = 4.66A, c (fiber axis) = 7.16A, and 4 monomer units per cell (19). The structure of the main chain is planar, the methyl groups have an alternating arrangement, one to the one side and the next to the other side of the plane of the chain. However, the tertiary carbon atoms are crystallographically equivalent, and in some respects the chains of crystalline polypropylene oxide are analogous to those of isotactic polymers. The chain can be described as a helix with twofold symmetry and two monomer units per turn.

The crystalline polypropylene oxide is more nearly analogous to protein molecules; as in the latter, its tertiary carbon atoms are situated between groups of considerably more different character than those in isotactic polymers (Formula 3, p. 176).

Stereoisomerism in polymers of conjugated diolefins

The number of stereoisomers in polymers of conjugated diolefins is very great, because two main types of isomerism are present: the traditional geometric isomerism (olefinic double bonds in cis and trans positions) in 1,4-linked polymers of asymmetric diolefins, and the traditional optical isomerism (due to the presence of asymmetric C-atoms) in 1,2- or 3, 4-linked polymers. Further isomerism is possible by combination of the types above in 1,4 polymers of certain asymmetric conjugated diolefins, such as piperylene.

For butadiene, the simplest conjugated diolefin, four stereoisomeric polymers with regular structures can be predicted (Fig. 2, p. 176). We have isolated and studied the trans-1,4-polybutadiene and the isotactic (20) and syndyotactic (8, 9, 11) 1, 2-polybutadienes (Table V, p. 178). We also obtained various types of amorphous polymer, i.e., mixed polymers with various contents of the respective types of configuration, some of them with a high content of the cis-1,4 form.

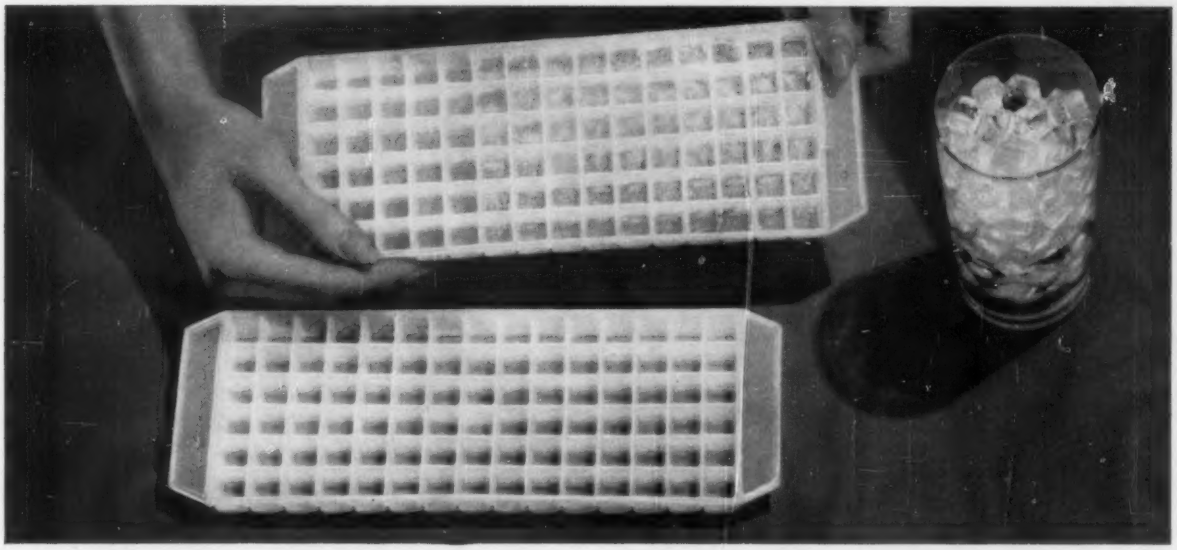
There are numerous possible combinations of the various types of chain linkage and steric configuration; therefore, a vast number of products with different properties is potentially obtainable, according to the ratio of the respective structure types assumed by the monomer units.

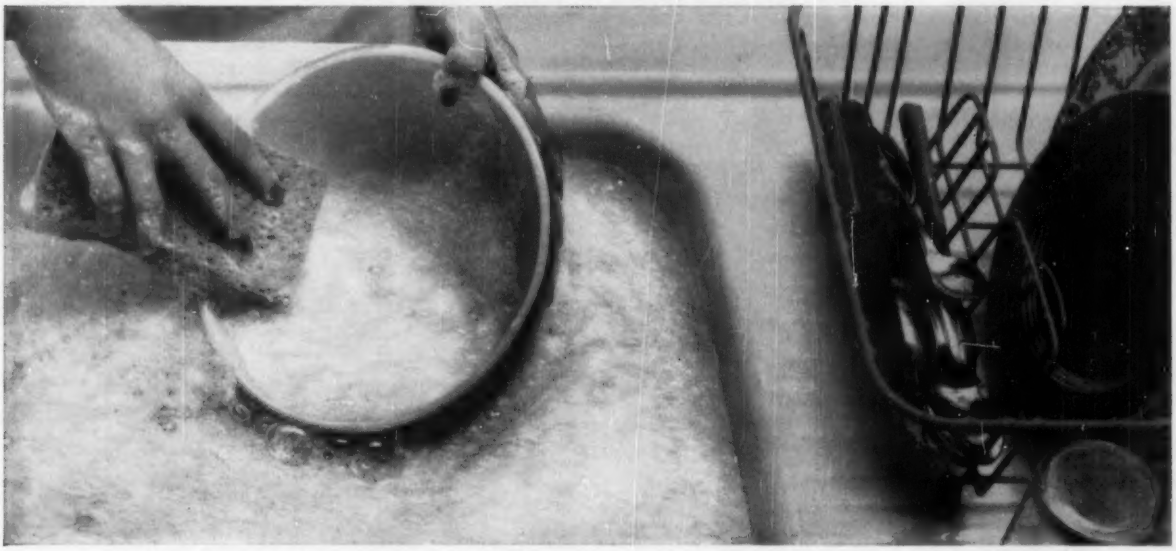
The old synthetic Buna rubber, as obtained by well-known processes of polymerizing butadiene,

Table IV: Comparison of the melting points of crystalline polymers of some straight and branched chain α-olefins

Straight monomer	*Melting point of polymer*[a]	*Branched monomer*	*Melting point of polymer*[a]
	°C.		°C.
$CH_3-CH=CH_2$	160	$CH_3-\underset{\underset{\displaystyle CH_3}{\vert}}{CH}-CH=CH_2$	240
$CH_3-CH_2-CH=CH_2$	128	$CH_3-\underset{\underset{\displaystyle CH_3}{\vert}}{CH}-CH_2-CH=CH_2$	205
$CH_3-(CH_2)_2-CH=CH_2$	80	$CH_3-CH_2-\underset{\underset{\displaystyle CH_3}{\vert}}{CH}-CH_2-CH=CH_2$	188
$CH_3-(CH_2)_3-CH=CH_2$	[b]	$CH_3-\underset{\underset{\displaystyle CH_3}{\vert}}{CH}-CH_2-CH_2-CH=CH_2$	130

[a]Determined by X-ray methods.
[b]Poly-n-hexene-1 is amorphous at room temperature, as prepared and purified by the same methods as the other poly-α-olefins.





Chain type:	
Polypropylene oxide	$-CH_2-\underset{}{CH}(CH_3)-O-CH_2-CH(CH_3)-O-$ $-A-B-C-A-B-C-$
Poly-α-aminoacids	$-NH-CH(R)-CO-NH-CH(R)-CO-$ $-A-B-C-A-B-C-$
Poly-α-olefins	$-CH_2-CH(R)-CH_2-CH(R)-CH_2-CH(R)-$ $-A-B-A-B-A-B-$

FORMULA 3

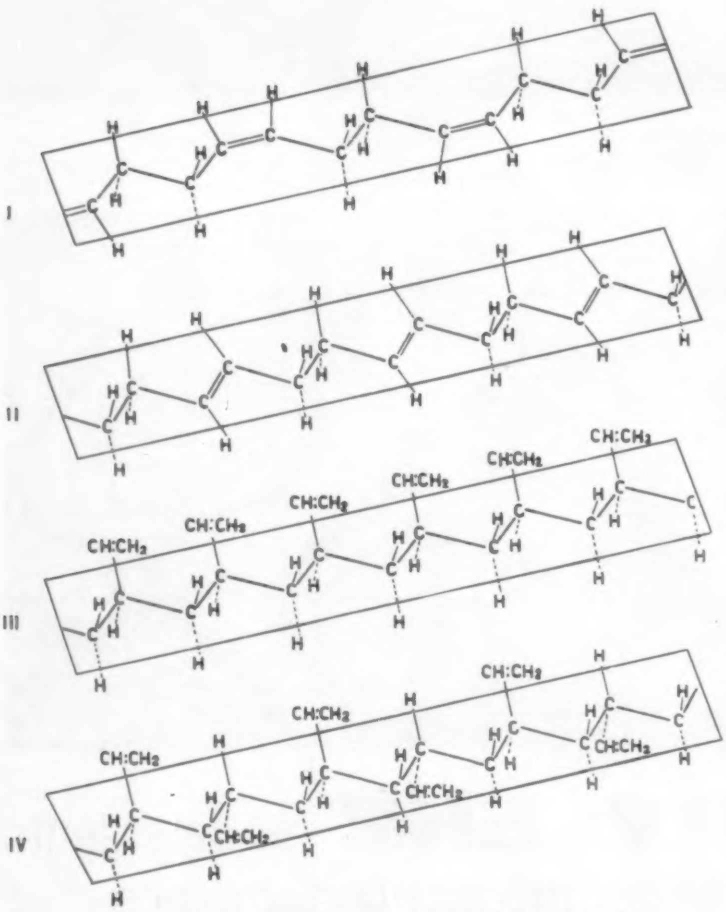


Fig. 2: Code: I—polybutadiene-1,4 cis; II—polybutadiene-1,4 trans; III—polybutadiene-1,2 isotactic; IV—polybutadiene-1,2 syndyotactic

contained irregular chains of monomer units in 1,4-trans, 1, 4-cis and 1,2 linkages. Morton (21) prepared a polybutadiene with a high concentration (up to 75%) of trans-links, but still insufficient to obtain highly crystalline stereoisomers.

Some of the eight possible isomeric and stereoisomeric polymers wth a regular linear structure of isoprene (2-methylbutadiene) have been synthesized at Milan and isolated in the pure crystalline state. For example, we have obtained in high yields highly crystalline (1,4-trans-polyisoprene with the same structure as natural gutta percha; the molecular weight can be varied over a range wider than in the natural polymer (22).

The synthesis of polymers with a high content of cis-1,4 links, analogous to natural rubber, was announced in 1955 by various American firms (23).

Asymmetric conjugated diolefins can form a very great number of stereoisomeric polymers with regular structures: e.g., 12 typical stereoisomers can be predicted for polypiperylene, i.e., four isomers with 1,4 links, two cis and two trans, each isotactic and syndyotactic, respectively; four with 1,2 links, i.e., two isotactic and two syndyotactic with the side chain double bonds in cis and trans position, respectively; and four with 3,4 links, according to the respective configurations of the four tertiary C-atoms in two neighboring monomer units.

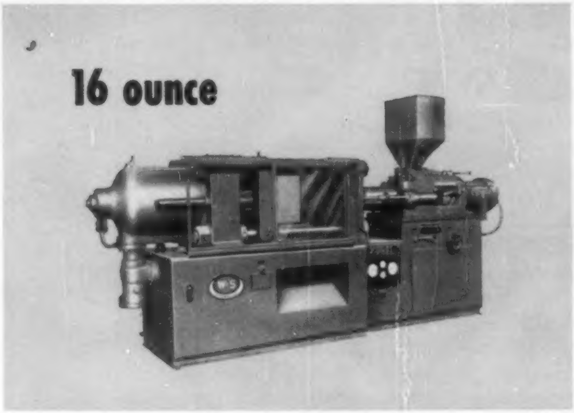
Characteristics of stereospecific polymerizations

The production of sterically homogeneous polymers with a perfectly regular structure requires catalytic processes fulfilling the following basic conditions. The polymerization must take place: 1) always in head-to-tail arrangement (no processes are known to give only head-head-tail-tail arrangements, except for low molecular weight polymers); 2) without formation of branches by chain transfer; 3) without formation of branches by copolymerization of the monomer with its lower polymers; 4) in a way such that the monomer units arrange themselves in well-ordered steric configurations.

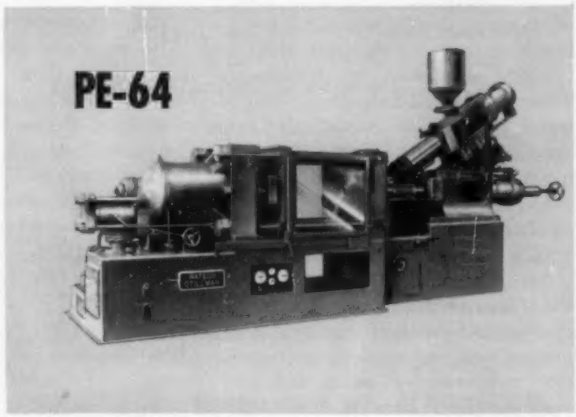
We have shown in previous papers (4, 8, 9) that all the stereospecific polymerizations of α-olefins so far described to give isotactic polymers depend on the presence of solid catalysts bound chemically to the growing polymer chain. Probably this stereospecific catalysis is related to the chemisorption of monomeric molecules on the surface of the solid catalyst; the adsorbed molecule is always presented to the growing chain in a definite orientation.

Obviously, not every solid catalyst is suitable for stereospecific polymerizations; a special surface

Does one of these
THREE NEW MOLDING MACHINES
meet your needs?



Maximum ounces per shot (Styrene)..............................16
Plasticizing capacity per hour................................150 lbs.
Maximum die sizes..........................20" x 36" x 21" x 33"
(Ask for bulletin 622)



Maximum ounces per shot (Styrene)............................90
Plasticizing capacity per hour...............................285 lbs.
Maximum die sizes.....................27" x 45" x 25" x 40½"
(Ask for bulletin 624)

Maximum ounces per shot (Styrene).............................24
Plasticizing capacity per hour.............................250 lbs.
Maximum die sizes........................27" x 45" x 25" x 40½"
(Ask for bulletin 623)

The three injection molding machines illustrated are recent additions to the Watson-Stillman "Completeline" of plastics equipment. Incorporating all the latest operating features, they reflect the continuing contributions being made by Watson-Stillman toward higher molding speed and accuracy.

In the market for molding machinery? There's no need to "shop around." At Watson-Stillman you can be sure of getting the performance you need. You choose from one of industry's most complete, most diversified lines. Horizontal injection molding machines range from 5 to 500 ounce capacities.

Ask for bulletin on any of the machines described.

WATSON-STILLMAN PRESS DIVISION
FARREL-BIRMINGHAM COMPANY, INC.
150 Aldene Road, Roselle, New Jersey
Plants: Ansonia and Derby, Conn., Buffalo and Rochester, N. Y.

OTHER FARREL-BIRMINGHAM PRODUCTS FOR THE PLASTICS INDUSTRY: Banbury Mixers • Roll Mills • Calenders • Extruders • Vertical Injection Molding Machines • Transfer Molding Machines • Compression Molding Machines

W-S HYDRAULIC

WS-21

structure is necessary to provide the active centers. Further, the catalytic process must conform with points 1 and 3 above.

Mechanism of processes suitable for stereospecific catalysis

Polymerizations that follow a free radical mechanism are usually not stereoselective. The use of certain conditions, e.g., low temperatures, can diminish chain transfer reactions; in diolefins, a certain type of linkage, e.g., the trans type or, in α-olefins, the syndyotactic head-to-tail type may thus be made more probable. Generally, however, radical mechanisms do not give polymers with a high structural regularity.

Cationic polymerizations have the disadvantage of frequent chain transfers which can be suppressed only by working at very low temperatures using monomers of the symmetrical vinylidene type. In rare cases, however, monomers with polar groups, associating with the catalyst, may give vinyl polymers containing fractions of regular structure. Thus, Schildknecht (24) obtained crystalline alkyl vinyl ether polymers; we have shown that these have an isotactic structure (25).

Our work on stereospecific polymerizations was mainly carried out with α-olefins and diolefins by means of special catalysts, probably acting by a mechanism of the anionic type. The characteristics of this type of polymerization conform to the above points 1 and 2 better than cationic mechanisms.

The catalysts first used were chosen from those suggested by Ziegler for the low-pressure polymerization of ethylene (26, 27). These catalysts polymerize vinyl hydrocarbons ($CH_2=CHR$) to high-molecular-weight polymers (28, 29), but not vinylidene hydrocarbons ($CH_2=CR_1R_2$).

Such catalysts are characterized by the presence of compounds of groups IV to VIII transition elements in an oxidation state lower than the maximum. Their atoms have a structure with incomplete d-shells. Their lower valency compounds (more stable towards bases) can associate with metal hydrides or alkyls to give complexes, sometimes occurring as surface compounds. In such complexes, metal-hydrogen or metal-alkyl bonds are present, highly polarized, with electron shift in the direction of formation of carbanions or hydride ions.

Not all transition elements are equally suitable for preparing the catalysts. We have found that those metals that give the best catalysts have the greatest tendency to lose electrons, as measured by their work functions and ionization potential (30). Those elements, underlined in Table VI, below, whose first work functions (less than 4 ev.) and first ionization potentials (less than 7 v.) are small, yield the best catalysts, in practice by reaction of their compounds with metal alkyls. Only the metals whose work function is smaller than 4 ev. (for example, Na, Li, Ba, Al) can form stable hydrides; in these, the metal-hydrogen bond is the more polarized (up to the limit of the H^- ion) the smaller the work function. In Pauling's electronegativity scale these elements have values below 1.7. For metal alkyl compounds of elements of low electronegativity, the metal-carbon bond can be assumed to be polarized in the direction of a carbanion.

The above-named transition elements are strongly basic only in components of their lowest valency state. This is the reason for their different behavior in the lowest and highest oxidation states. The latter, like $VOCl_3$ and $TiCl_4$, are Lewis-acids and, with co-catalysts such as HCl, H_2O, or alkyl halides, they give complex catalysts with a cationic mechanism, because of the presence of protons or carbonium ions. However, compounds of lower oxidation states, e.g., VCl_3 and $TiCl_2$, react with metal hydrides or metal alkyls to give catalysts with an anionic mechanism, due to the presence of hydride ions or carbanions.

In the reaction of transition metal compounds in the highest oxidation state with metal alkyls, a catalyst suitable for an anionic mechanism can only be obtained by an exchange reaction, leading to unstable alkyl compounds; the latter decompose (often with formation of free radicals or their dimerization or disproportiona-

Table V: Crystalline stereoisomers of polybutadiene

Chain structure	*Melting point*	*Identity period*	*Monomer units*	*Density (cryst.)*
	°C.	A		
1-2 isotactic	120	6.5	3	0.96
1-2 syndyotactic	154	5.14	2	0.96
1-4 trans	135	4.9	1	1.01

Table VI: Properties of some catalytic transition metals

Catalytic transition metal	*Work function in ev.*	*Ionization potential in volts*			*Electronic structure of the atom*	
		I	*II*	*III*		
Ti	3.9	6.8	13.6	27.6	3 d^2	4 s^2
V	3.8	6.7	14.1	26.5	3 d^3	4 s^2
Cr	3.7	6.7	16.7	32	3 d^5	4 s
Mn	3.8	7.4	15.6	34	3 d^5	4 s^2
Fe	4.7	7.8	16.5	30	3 d^6	4 s^2
Ni	5.0	7.6	18.2	36	3 d^8	4 s^2
Zr	3.7	6.9	14	24.1	4 d^2	5 s^2
Mo	4.11	7.06		(27)	5 d^5	5 s
W	4.5	7.94		(24)	5 d^4	6 s^2

Kodapak Sheet

"Kodapak" is a trademark for Eastman's plastic sheet.

amazes the experts

THREE YEARS' exposure to sun, rain, snow, and city grime didn't mar the surface of this Emerson dealer sign, vacuum-formed from 60-gauge Kodapak Sheet, then spray-painted. Even experts, who compared it with a new design, would have been hard put to tell which was the old and which the new, had not color specifications been changed during the period!

How comes Kodapak Sheet's superior weathering ability? Answer: Kodapak Sheet is chemically stable . . . tough, durable—free from surface defects . . . resists air-borne dust, dirt, acids and alkalis.

Interested in street signs? Highway or traffic markers? Displays? Outdoors and indoors, "Kodapak Sheet makes good merchandise better." Call representative or write.

Signs designed and manufactured by Spangler Sign Works, Philadelphia, Pa. for Emerson Radio and Phonograph Corp.

Cellulose Products Division, EASTMAN KODAK COMPANY, Rochester 4, N. Y.

Sales Offices: New York, Chicago, Atlanta. Sales Representatives: Cleveland, Philadelphia, Providence.
Distributors: San Francisco, Los Angeles, Portland, Seattle (Wilson & Geo. Meyer & Co.); Toronto, Montreal (Paper Sales, Ltd.).

tion products), reducing then the transition metal compound to a lower valency. Ziegler (27) first observed this reduction in the reaction of $TiCl_4$ and $Al(C_2H_5)_3$, giving the catalyst suggested for the polymerization of ethylene.

Comparison of our process with that usually supposed to follow a cationic mechanism makes the hypothesis of an anionic mechanism very probable for the former. This hypothesis is supported by the presence of metal-hydrogen or metal-carbanion bonds in the most typical of the catalysts, as well as by the spectrographic investigation of the polymers and the kinetic study of the polymerizations of ethylene (31) and propylene (32) with metal alkyls.

Table VII: Comparison of cationic and anionic polymerization processes

	Cationic	*Anionic*
Catalyst	Salts of carbonium ions or acids.	Salts of carbanions or metal hydrides.
Chain starters	H^+, $-R'R''C^+$	H^-, $-\bar{C}H_2$, $-Ar^-$
Other ions	Anions: $(BF_3OH)^-$, $(AlBr_4)^-$	Cations: $(TiAlX_n)^+$, AlX_2^+
Principal catalysts	Salts of strong acids with weak bases, electrophilic substances, compounds of group II-IV and higher group metals in their highest oxidation state (e.g., $AlCl_3$, $TiCl_4$).	Salts of strong bases, nucleophilic materials. Compounds of the lowest oxidation states of group IV-VIII metals ($TiCl_2$, VCl_2, etc.).
Co-catalysts	Substances giving rise to protons or carbonium ions: hydrogen halides, alkyl halides (HCl, H_2O, CH_3Cl, etc.).	Substances giving rise to hydride ions or carbanions: metal hydrides, metal alkyls (LiH, $LiCH_3$, Al $(C_2H_5)_3$).
Scale of increasing reactivity of olefins:		
Small	$CH_2{=}CH_2$	$R_1R_2C{=}CH_2$
Medium	$RCH{=}CH_2$	$RCH{=}CH_2$
Large	$R_1R_2{=}CH_2$	$CH_2{=}CH_2$
Inhibitors	Electron donors: bases, amines, alcohols	Electron acceptors: acids, water, aliphatic halides.
Solvents	Hydrocarbons. Large influence of dielectric constant.	Hydrocarbons, aromatic halides.
Kinetics	Usually first order with respect to catalyst and monomer, and zero order with respect to cocatalyst (above a certain minimum concentration). Frequent exceptions and anomalies.	First order with respect to catalyst and monomer, and zero order with respect to cocatalyst (above a certain minimum concentration). Anomalies with unstabilized heterogeneous catalysts.
Apparent activation energy	Always small (<15,000 cal.), sometimes negative.	Always small.
Stopping of the growing macromolecular chain.	By transfer of a proton to the catalyst (dissociation) or to the monomer (chain transfer).	By transfer of a hydride anion to the catalyst (dissociation) or to the monomer (chain transfer).
Charge transfer from one C-atom to another in the same chain.	Frequently from a secondary to a tertiary C-atom.	Transfer from a primary to a secondary or tertiary carbon atom improbable and so far not observed.
Copolymerization of the monomer with its own polymer.	Frequent	Only with ethylene under certain conditions, not observed with α-olefins.
Structure of polymer formed.	Usually irregular, presence of long branches, and sometimes cyclization of the chain	Regular, absence of long branches and cycles in α-olefin polymers.

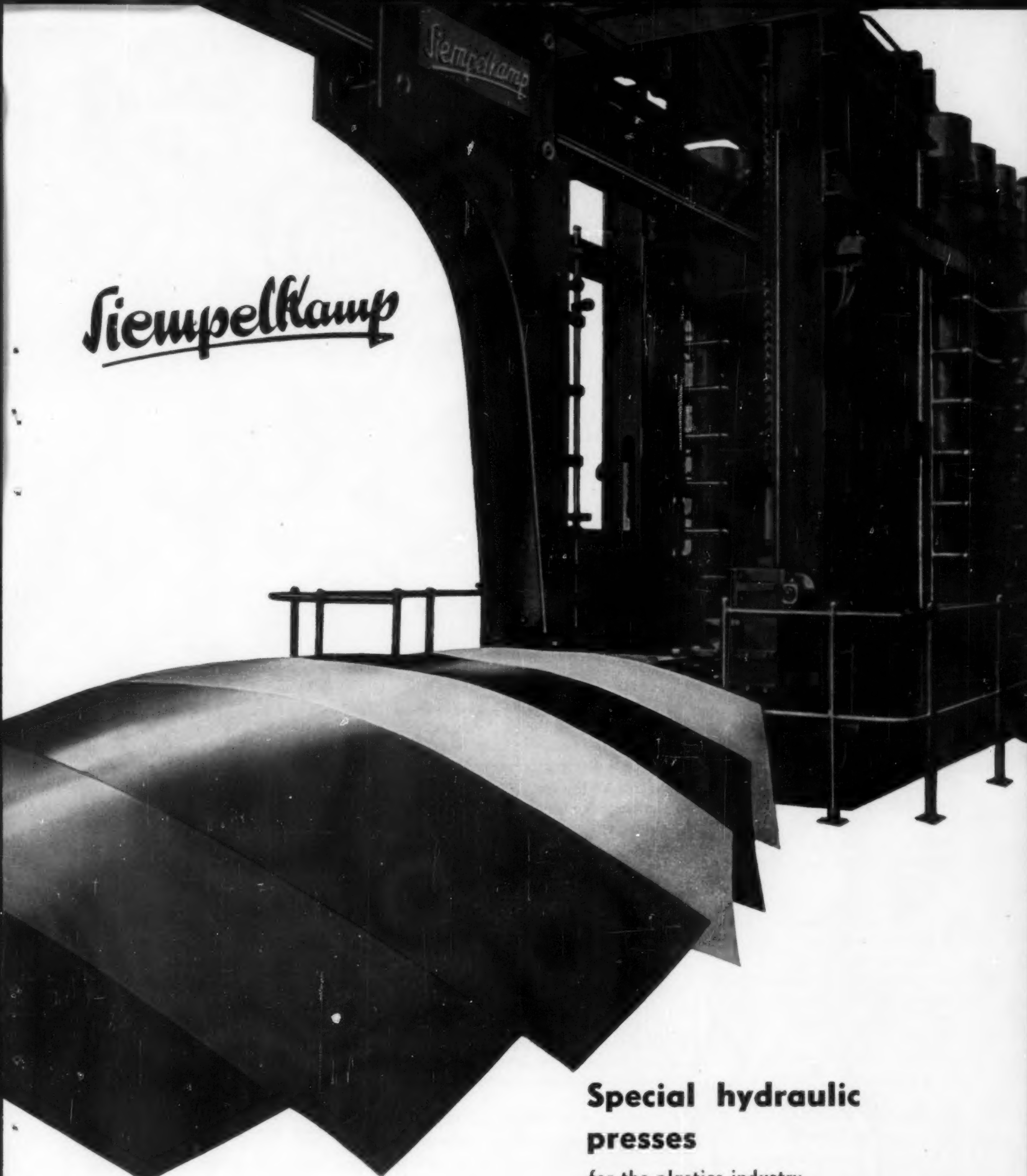
In our opinion, the polymerization of vinyl monomers takes place by a monomer entering in between the catalyst and the growing polymer chain in such a way that the CH_2 group is bound to the catalyst. The chain growth stops usually either by dissociation (regeneration of the catalyst with formation of a metal hydride grouping) or by transfer of the charge from the polymer to a monomer (chain transfer with the monomer), but in every case with the formation of a high-molecular-weight polymer, unsaturated because of the terminal vinylidene group. This is proven by the following experimental facts (15).

1) When using catalysts, obtained by treatment of aluminum alkyls with transition metal compounds, those organic groups (alkyl or aryl) originally present in the aluminum alkyl used were found in the polymer: e.g., an aluminum triphenyl titanium compound catalyst gives a polymer containing phenyl groups bound to tertiary carbon atoms (13.26 and 14.33μ bands found in various fractions of the polymer).

2) With stabilized catalysts, the polymerization rate is constant, provided the concentration of monomer is kept constant. Therefore the polymerization proceeds at a constant number of active centers, which is proof that the catalyst is not consumed during the polymerization process.

3) With a titanium salt/aluminum triphenyl catalyst the number of phenyl end groups in the polymer decreases with the progress of polymerization; e.g., after 4 to 5 hr. at 90° C., the ratio of the number of polymer molecules to the number of phenyl end groups varies from 3 to 8, according to the fraction. Although the catalyst initially contains metal-phenyl bonds, the polymerization proceeds even after the phenyl groups have been removed from the catalyst and replaced by other metal alkyl bonds.

4) Unpublished kinetic measurements show the average life


Siempelkamp

$$CH_3{-}CH_2{-}(CH_2{-}CH_2)_n{-}CH{=}CH_2 + R{-}CH_2{-}CH_2{-}CH_2{-}\bar{C}H_2 + m\,(CH_2{=}CH_2) \rightarrow$$

$$\rightarrow CH_3{-}CH_2{-}(CH_2{-}CH_2)_n{-}\underset{\displaystyle R{-}CH_2{-}CH_2{-}CH_2{-}CH_2}{\underset{|}{CH}}{-}CH_2{-}(CH_2{-}CH_2)_{m-1}{-}CH_2{-}\bar{C}H_2$$

FORMULA 4

of a growing polymer chain to be 10 min., with heterogeneous catalysts not above 100° C.

5) The polymer chains contain double bonds, mostly of the vinylidene type. The number of vinylidene groups is roughly equal to the number of polymer molecules as calculated from the viscosimetrically determined molecular weight of fractions. These double bonds are formed by the splitting of metal-alkyl bonds, and a primary carbanion can be assumed to have been linked to a cation of the catalyst.

6) Comparison of osmotic and viscosimetric measurements on solutions and the behavior of molten, very high-molecular-weight polymers lead to the conclusion that the macromolecules are linear and free from long branches.

7) The remarkably regular structure of polymers obtained by this type of anionic catalysis and the probable absence of long branches can be ascribed to the greater stability of a primary carbanion, so that chain transfers to secondary or tertiary C-atoms do not occur.

The activation energy of the over-all polymerization reaction is not very high and usually does not exceed 15,000 cal. The activation energy of the polymerization of propylene to isotactic polymer was found to be 11,000 cal., calculated for the gaseous state (or 15,000 cal. for propylene dissolved in heptane).

Comparison of catalytic processes

There are remarkable analogies between anionic and cationic catalysis, but the two processes differ with regard to the mechanism and to the possibility of chain transfers (Table VII, p. 180). The greater regularity of structure, observed in the products of certain anionic polymerization reactions, is caused by the presence of terminal carbanions ($-\bar{C}H_2$); the charge of this group has no tendency to migrate to other atoms in the chain. In cationic catalysis, however, the transfer of a hydride ion from a tertiary to a secondary carbonium ion, involving neutralization and formation of a teritary carbonium ion, is possible and occurs frequently. This is one cause of branched chains.

Anionic processes are more suitable than cationic for the production of polymers with regular structure, because transfer reactions are less frequent. In cationic polymerization, regular structures are obtainable only by working at very low temperatures. Our anionic polymerizations give higher molecular weights at the same polymerization temperature and polymers with linear head-to-tail structure even if the polymer is atactic.

In a growing polymer chain that ends with the ion $\bar{C}H_2$, a shift of the negative charge to a carbon atom inside the chain is impossible, as the latter is less electrophilic. Hence, the chain cannot branch, and poly-α-olefins are strictly linear and linked head to tail, provided they are prepared by a catalyst with an anionic type of mechanism, even if not truly stereospecific. No

$$-CH_2{\cdot}CH_2- \text{ or}$$
$$-CH(CH_3){\cdot}CH(CH_3)-$$

groups could be found in the infrared spectra of polypropylenes, prepared by means of such catalysts.

With cationic catalysts, chains of regular structure are obtainable only if the carbonium ion is tertiary at the start and if no other more nucleophilic carbon atoms are present (e.g., polyisobutylene).

In anionic catalysis, poly-α-olefins can have greater structural regularity than polyethylene. In the polymerization of ethylene, copolymerization of ethylene and low polymers is possible, giving rise to chain branches, as shown in Formula 4, left. In our opinion, this accounts for chain branching of polyethylenes obtained with certain catalysts, while the same catalysts give only linear polymers of α-olefins.

Chain branching does not occur in the polymerization of α-olefins, because the reaction shown in Formula 5, below, cannot proceed for steric reasons when using the typical anionic catalysts. Even in low molecular weight polymers it proved impossible to find evidence for the presence of quaternary carbon atoms.

This different behavior of the products of anionic polymerizations is observed even in sterically disordered α-olefin polymers. Amorphous polypropylenes, polybutenes, polyamylenes, and polyhexenes of medium and high molecular weight are different from those of identical molecular weight obtained by cationic processes. The former are similar to unvulcanized rubber in their viscoelastic behavior.

Stereospecific catalysts for isotactic polymers

We have seen in the preceding section that at temperatures above normal it is only possible to make vinyl polymers of a definite regularity of structure (head-to-tail bonding, absence of branching) by processes that apparently proceed by an anionic methanism. Other polymerization processes can yield structures of such regularity only at very low temperatures. I should like to discuss now which of the catalysts described can act in a stereospecific manner.

The first stereospecific polymers obtained were isotactic poly-α-olefins and poly-diolefins with

(*To page* 261)

$$-CH_2{-}CHR{-}CH_2{-}CHR{-}\bar{C}H_2 + P_1{-}\underset{\displaystyle R}{\underset{|}{C}}{=}CH_2$$

$$\rightarrow -CH_2{-}CHR{-}CH_2{-}CHR{-}CH_2{-}\overset{\displaystyle P_1}{\overset{|}{\underset{\displaystyle R}{\underset{|}{C}}}}{-}\bar{C}H_2,$$

FORMULA 5

Extruded from styrene, the slats of this new shade transmit light while providing privacy. Their smooth surfaces permit easy cleaning, are highly resistant to chipping and discoloration.

A broad selection of plastics from a...

Single source of supply

PHENOLICS
STYRENES
VINYLS
IMPACT STYRENES
POLYETHYLENES
POLYESTERS
EPOXIES

The success of your product depends on the choice of the right material and the service available to help you apply the material to fullest advantage. Bakelite Company provides several means of helping you . . . a broad selection of materials—plastics and resins that cover a wide range of applications . . . prompt delivery and service through strategic location of plants and warehouses . . . the guidance of technical representatives backed by extensive research and development facilities. All these are available to you from this single convenient source.

continued on next page

continued from preceding page

Slats for "Glo-Lite" plastic shades are made by **Artcraft Venetian Blind Mfg. Co.**, St. Louis, Mo., from "Polyflex" plastic sheets produced by **Plax Corp.**, P. O. Box 1019, Hartford, Conn.

Flexible, translucent polystyrene for window shades

Here's a window shade that's different. It permits light without glare, privacy without gloom. Its slats, formed of BAKELITE Brand Styrene, are tough and flexible, easy to clean. The color—a choice of white, ivory, beige, or pastel green—is in the material, so it won't scratch off or chip away. Since these blinds are unaffected by corrosive atmospheres or chemicals, they are popular at the sea shore, where those made from other materials have been quick to corrode and discolor.

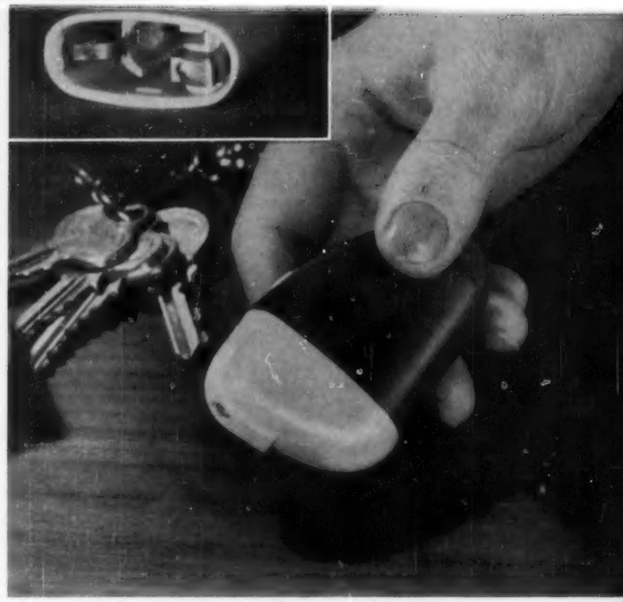
The slats are cut from extruded sheets of BAKELITE Styrene, oriented during extrusion for added flexibility. A variety of stock and custom widths is produced. After the slats are cut, they are shaped in heated dies, retaining their surface gloss throughout the process. The resulting product is a good example of the performance and fabrication advantages of BAKELITE Styrene.

Polyethylene mudguard—contoured, flexible, tough, chemical resistant

This new kind of mudguard for trucks and trailers promises to beat the problems encountered in earlier types. Molded of BAKELITE Brand Polyethylene, it has superior impact and flexural strength—won't dent or bend permanently against loading docks. The chemical resistance of BAKELITE Polyethylene gives the guard lasting protection against alkalies, salts, tars, and other corrosive materials—there is no problem of rust or corrosion. The manufacturer also states that ice and snow will not build up on this mudguard, thus eliminating a hazard frequently encountered with conventional types.

The guard is molded in three sections fastened together to form a contoured unit. Although it weighs only seven pounds, it is rigid enough to keep its shape at high speeds. The properties and performance of polyethylene have led the manufacturer to expect much longer life for these new mudguards than for conventional types.

Polyethylene mudguards (patent pending), are manufactured and injection molded by



"Eveready" Thin Light battery case molded by **Quinn-Berry Corp.**, Erie, Pa.

Tiny flashlight case spotlights moldability of styrene plastic

Here is an intricate, accurately molded case for an "Eveready" change-pocket flashlight, the "Thin Light." Made of BAKELITE Brand Styrene Plastic SMD-3500, the case features a streamlined pistol grip and easy, drop-in battery loading. It comes in three attractive color combinations. All models have an ivory head that provides side light diffusion.

A look inside reveals the fine molding details of the case's two sections. It holds two batteries and a bulb, and is fitted with a positive, snap-action switch. The gleaming finish, inside and out, is characteristic of products made from this material. BAKELITE Styrene SMD-3500 is equally serviceable for large and small sections, and is noted for its high plasticity and fast set-up, factors that permit effective reductions in molding cycles.

C-11 tumblers make repeat-sale packages

These tumblers for packaging cottage cheese show what BAKELITE Brand C-11 Plastics can do for sales. Their variety of jewel-like colors makes a striking display. Their gracefully molded shape points up their reusability for any occasion. They're tough and hard to break—a packaging advantage as well as a selling point.

These features are due to the use of BAKELITE C-11 Plastic—a styrene-acrylonitrile copolymer. The tumblers will withstand automatic dishwasher temperatures up to 180 deg. F. C-11 is virtually unaffected by soaps, detergents, food chemicals, coffee, tea, citrus peels, cosmetics, alcohol, ink, oil, and other household items. Their caps are molded of BAKELITE Brand Styrene Plastic, clean and sharply detailed, that also serve as coasters.

Tumblers and lids molded by **Peoria Plastic Co.**, East Peoria, Ill.

One plastics source...

PHENOLICS
STYRENES
IMPACT STYRENES
POLYETHYLENES
VINYLS
POLYESTERS
EPOXIES

BAKELITE BRAND **PLASTICS**

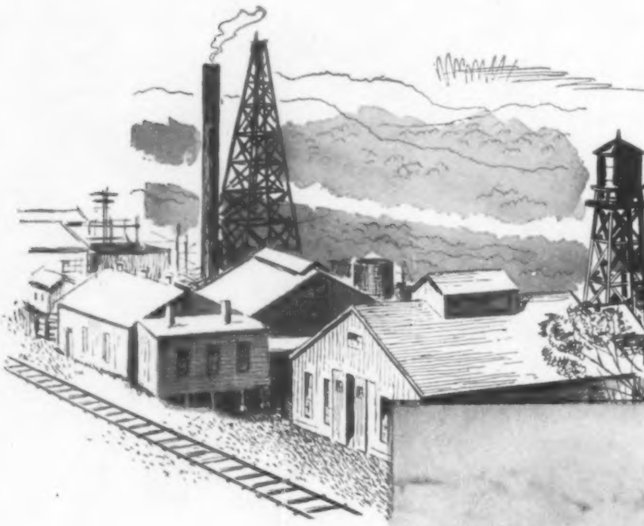
BAKELITE COMPANY

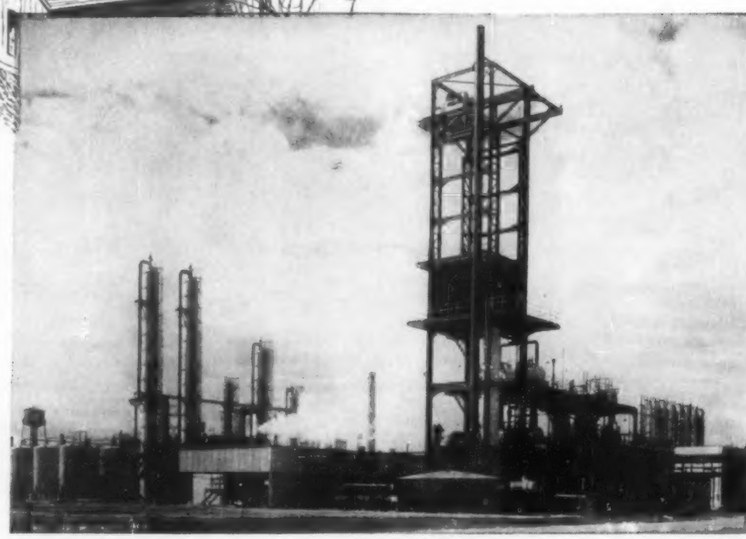
A Division of Union Carbide and Carbon Corporation UCC
30 East 42nd Street, New York 17, N. Y.

In Canada: Bakelite Company, Division of Union Carbide Canada Limited, Belleville, Ontario.

The terms BAKELITE, EVEREADY, and the Trefoil Symbol are registered trade-marks of UCC.

Polyethylene mudguards (patent pending), are manufactured and injection molded by





design makes a difference

and

FLEXOL PLASTICIZER 10-10 *is designed for low volatility*

Trade Mark

In plasticizers as in chemical plants, design is important. CARBIDE's Oxo unit at Texas City, Texas, shows progress in plant design from our original plant at Clendennin, West Virginia. And primary decyl alcohols from the huge Oxo unit are used in making FLEXOL Plasticizer 10-10 (didecyl phthalate), CARBIDE's newest plasticizer.

FLEXOL 10-10 is designed specifically to give you low volatility combined with outstanding electrical properties, improved resistance to water extraction, and excellent heat and light stability. Plastisols prepared with 10-10 have better viscosity stability.

You will find that FLEXOL 10-10 provides additional performance characteristics in your calendered film and sheeting, profile extrusions, electrical insulation, coated fabrics, slush-molded or dip-molded articles, and other vinyls that require low volatility.

Continuing progress in raw materials production enables CARBIDE to design top-quality plasticizers for you. Our basic raw materials position also means a continuing supply of 10-10 in the quantities you need.

Get all the information on this newest, least volatile phthalate from the nearest of CARBIDE's 25 sales offices. In Canada: Carbide Chemicals Company, Division of Union Carbide Canada Limited, Toronto.

CARBIDE AND CARBON CHEMICALS

Carbide and Carbon Chemicals Company
A Division of
Union Carbide and Carbon Corporation
30 East 42nd Street UCC New York 17, N. Y.

The term "Flexol" is a registered trade-mark of Union Carbide and Carbon Corporation.

Climbing peel test for strength of

Adhesive bonds

By Fred Werren and H. W. Eickner**

Various methods of determining the peeling resistance of adhesive bonds in sandwich constructions have been proposed. A climbing peel test has been developed at the Forest Products Laboratory that incorporates many of the desirable features of proposed methods, and yet is simple in design and operation. Furthermore, the method is adaptable to the testing of metal-to-metal bonds. A description of the test method is presented herein. With changes in the type of specimen and testing techniques, the peel strength of bonds between other materials may also be determined.

Testing procedures to evaluate the quality of adhesive bonds in sandwich and bonded metal-to-metal constructions have been developed to the degree that standardization of methods is possible for determining tensile and shear strength. Many fabricators of these bonded constructions feel that a third general property of adhesive bonds, the resistance to peeling, is also required to properly evaluate the quality of adhesive bonds. Peel strength, while not considered in setting design stresses, may be important in resisting peeling stresses in bonded panels such as might occur during handling, machining, or in localized areas because of load concentrations and defective or damaged sections.

Many different methods of evaluating the peel resistance of adhesive bonds have been developed, particularly by the aircraft industry. Test apparatus has varied from a simple tension-type strip test to a rather elaborate self-contained peel-test machine. Many investigators consider that any peeling apparatus should peel at essentially a constant radius of peeling.

The Forest Products Laboratory, in cooperation with the Materials Laboratory, Directorate of Research, Wright Air Development Center, has evaluated several of the existing peel methods, and some data are presented in a WADC report.[1] During 1954, the Forest Products Laboratory climbing peel test was developed as a simplified test method incorporating some of the desirable features of other peeling methods. Subsequently, many peel tests have been made with the climbing peel and other peel-test methods.

Principles of operation

The climbing peel-test apparatus is essentially a spool-type drum of two diameters, as shown in Fig. 1, right. The end of the facing to be peeled is clamped tangent to the point of contact on a drum of radius r_i. The other end of the facing is fastened to the top head of a testing machine. One end of a thin stainless-steel loading strap, or other suitable flexible strap or cable, is attached to each flange of the apparatus. The other end of each strap is connected by a pin to a loading bar to assure uniform tension in each strap when load is applied. The radius from the center of the drum to the mid-depth of the loading strap is r_o (Fig. 1).

When the specimen and peeling apparatus are placed in a testing machine, tensile loads are applied to the facing and to the straps. From Fig. 1, the facing load, P_1, produces a clockwise torque on the drum, while the strap load, P_2, produces a counterclockwise torque. At some load, the torque P_2r_o will be large enough to overcome the sum of the clockwise torque P_1r_i and the peeling resistance of the sandwich bond, and the drum will rotate counterclockwise. As it does so, the drum will peel the facing from the sandwich and progressively climb upward on the specimen. If load and head travel are recorded

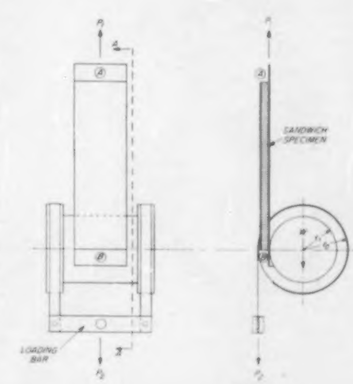


Fig. 1: Sectional drawings of climbing peel test apparatus, showing construction and test set-up

Research reported herein was sponsored by the Materials Laboratory, Wright Air Development Center, Wright-Patterson Air Force Base, Ohio.

*Engineer and chemical engineer, respectively, at the Forest Products Laboratory, Forest Service, U. S. Department of Agriculture, maintained at Madison, Wis., in cooperation with the University of Wisconsin.

[1] WADC Technical Report 54-138, "Comparisons of Test Methods for Evaluating Adhesives for Bonding Metal Facings to Metal Honeycomb Cores," July 1954.

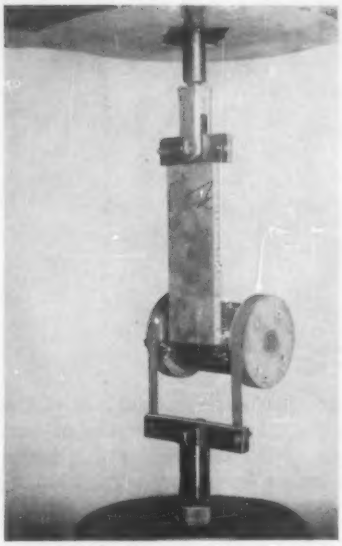


Fig. 2: Original climbing peel tester, with a sandwich specimen in place before peeling has started

autographically, an average peeling load and peeling torque can be determined.

The torque required to overcome the weight of the drum, W, must be considered in the calculations. If the drum is balanced so that its center of gravity passes through the center of the drum,

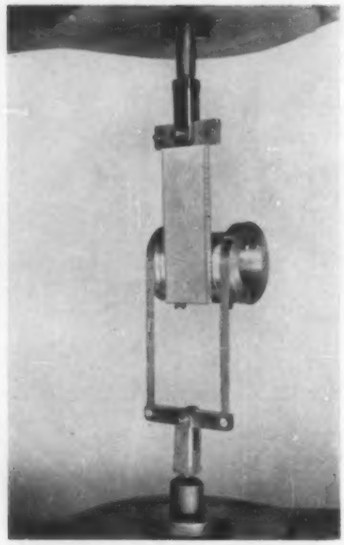


Fig. 3: Aluminum model of original climbing peel tester in process of peeling a sandwich specimen

as shown in Fig. 1, then the load in the straps required to counteract the weight of the drum will be

$$P_c = \frac{Wr_i}{r_o - r_i}$$

where P_c is the force required to counteract the weight of the drum in pounds, W is the weight of the drum in pounds, r_i is the radius in inches from center to inner surface of drum, and r_o is the radius in inches from center of drum to mid-depth of loading strap.

Thus, the load to cause peeling will be

$$P_p = P_2 - P_c ,$$

where P_p is the peeling load in pounds and P_2 is the total strap load in pounds. Also, from inspection,

$$P_1 = P_2 + W$$

where P_1 is the total load in pounds in the facing to be peeled.

The peeling torque, T, is equal to the peeling load times the moment arm, or

$$\begin{aligned} T &= P_p\ (r_o - r_i) \\ &= (P_2 - P_c)\ (r_o - r_i) \\ &= P_2\ (r_o - r_i) - Wr_i \end{aligned}$$

The weight of the loading straps and loading bar was not included in the discussion since it is generally small.

The peeling torque calculated by the method described includes that required to bend the sandwich facing, as well as to peel the facing from the core. Therefore, for comparative evaluation of adhesives, facings of the same material and thickness should be used. Some laboratories have indicated that they compensate roughly for

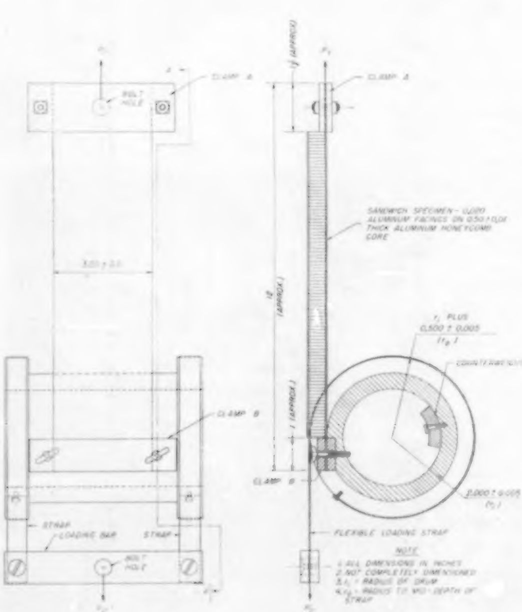


Fig. 4: Apparatus and test specimen for making peel tests on sandwich constructions

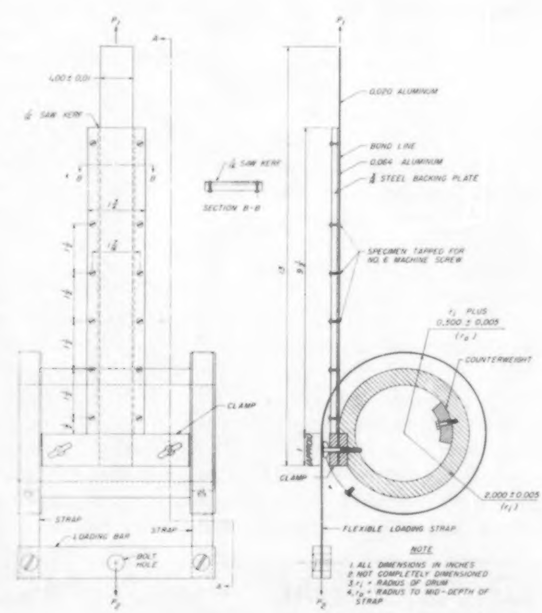
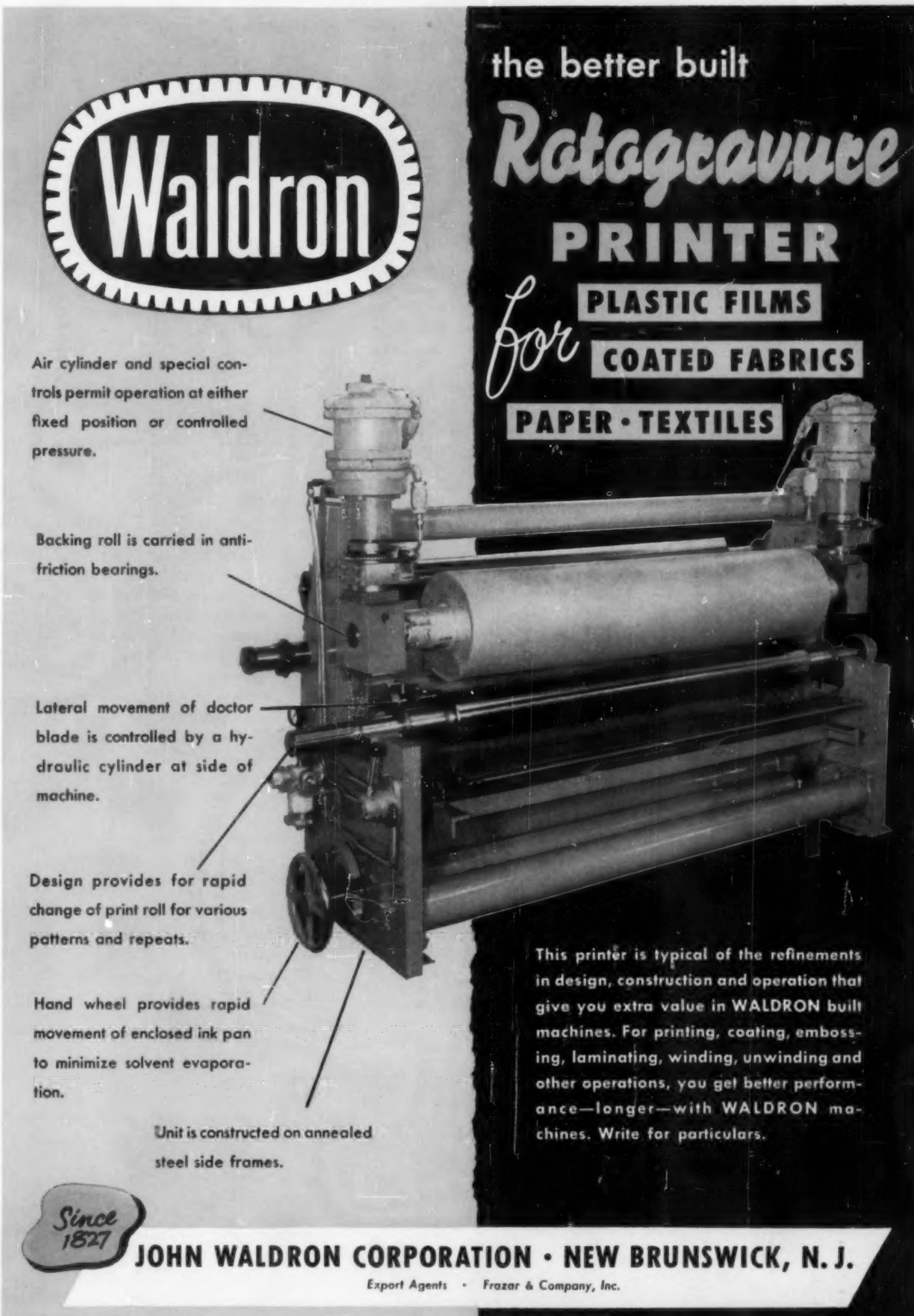


Fig. 5: Apparatus and test specimen used for making peel tests on metal-to-metal bonds


Waldron
the better built
Rotogravure
PRINTER
for
PLASTIC FILMS
COATED FABRICS
PAPER • TEXTILES
Air cylinder and special controls permit operation at either fixed position or controlled pressure.
Backing roll is carried in anti-friction bearings.
Lateral movement of doctor blade is controlled by a hydraulic cylinder at side of machine.
Design provides for rapid change of print roll for various patterns and repeats.
Hand wheel provides rapid movement of enclosed ink pan to minimize solvent evaporation.
Unit is constructed on annealed steel side frames.
This printer is typical of the refinements in design, construction and operation that give you extra value in WALDRON built machines. For printing, coating, embossing, laminating, winding, unwinding and other operations, you get better performance—longer—with WALDRON machines. Write for particulars.
Since 1827
JOHN WALDRON CORPORATION • NEW BRUNSWICK, N. J.
Export Agents • Frazar & Company, Inc.

the torque required to bend the facing by testing a piece of unbonded facing. This may be done, but the forces imposed during such a test are substantially different from those imposed during the peeling of a bonded facing. If this compensation is preferred, then the alternate equation for corrected peeling load, P_p', is

$$P_p' = P_p - P_f$$

where P_f is the force in pounds required to roll a piece of unbonded facing on the drum. Thus, the alternate peeling torque, T', could be computed from the equation

$$T' = (P_p - P_f)\ (r_o - r_i)$$

Test apparatus

The original climbing peel tester was made of a 4-in.-diameter laminated oak drum and two 5-in.-diameter plywood flanges, and was designed to peel thin facings from sandwich constructions. The apparatus is shown in Fig. 2, p. 188. Subsequently, an aluminum model of the original tester (Fig. 3) was fabricated at the Materials Laboratory, Wright Air Development Center. This test apparatus, a drawing of which is shown in Fig. 4, p. 188, has been found suitable for peeling facings from aircraft sandwich materials made with relatively thin facings.

The climbing peel tester was used in a universal-type hydraulic testing machine with a load range of zero to 600 pounds. Load was applied at a constant rate of head movement, usually 1 in./minute. An autographic record of load versus head movement was obtained.

Test procedure

To date, approximately 175 sandwich specimens have been tested at the Forest Products Laboratory with the climbing peel tester. The 3- by 12-in. sandwich specimens were made of 0.020-in. aluminum facings bonded to a ½-in. aluminum honeycomb core (0.002-in. foil expanded to 3/16-in. cells). Eleven different adhesive bonding systems were used. Based on the experience gained in these tests, it appears that the following conditions provide suitable test results for the type of sandwich materials used: 1) a drum diameter of 4.00 in., 2) a flange diameter of 5.00 in. to the mid-depth of the loading straps, 3) specimens 3 by 12 in. in size, and 4) a peeling rate of 4 in./minute. The testing machine head speed will be 1 in./min. for drum and flange diameters given.

The average peeling resistance (torque in in.-lb.) can be computed from an autographic curve of load versus distance peeled for the 5 in. of peeling between 1 and 6 in. of peel.

Table I: Results of peel tests of sandwich and metal-to-metal specimens tested with the climbing peel test apparatus. Facings peeled were 0.020-in. clad 2024-T3 aluminum

	Adhesive system[a]	*—Average peel strength*[b]*—* *Sandwich*	*Metal-to-metal*
		in.-lb.	*in.-lb.*
A	(epoxy liquid)	4.3	6.3
A_1	(same as A, modified bonding conditions)	6.1	7.7
B	(an elastomer-modified phenolic on glass fabric)	10.8	22.2
C	(nitrile rubber-phenolic liquid)	24.9	44.1
D	(vinyl-phenolic on glass fabric)	13.1	7.0
E	(liquid form of D)	5.1	7.7
F	(two-component formulation of phenolic liquid and vinyl polymer powder)	2.7	6.8
G	(epoxy-phenolic on glass fabric)	3.3	7.2
H	(nitrile rubber phenolic unsupported film)	4.3	34.3
I	(liquid primer and unsupported film of nitrile-rubber and phenolic)	5.7	39.9
J	(similar to I, except film supported on glass fabric)	25.6	—

[a]Not all of the adhesive systems used were recommended for bonding both sandwich and metal-to-metal specimens.

[b]Average peel strength expressed in torque per inch of soecimen width. Each value is an average of 3 sandwich specimens or 5 metal-to-metal specimens.

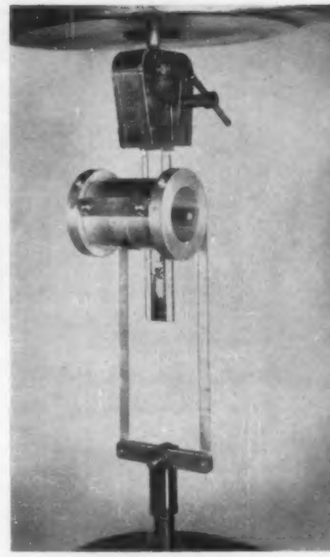


Fig. 6: Completed climbing peel test on a metal-to-metal bonded specimen

In determining the peeling torque, T, it is desirable to suspend the specimen and test apparatus from the top head of the testing machine and then balance the machine load to zero. The loading bar may then be connected to the lower head, and an initial load P_c applied to overcome the torque due to the weight of the drum. An additional load, P_p, will be required to peel the facing. Peeling torque is simply this peeling load multiplied by the moment arm, or

$$T = P_p\ (r_o - r_i)$$

It is recommended that the initial load P_c required to counterbalance the weight of the drum be determined by actual test. This is readily accomplished by inserting a strip of thin fabric with negligible stiffness in place of the sandwich specimen and applying a load great enough to cause the drum to roll upward around the fabric. This load will be about equal to the calculated value of P_c, which is $Wr_i/(r_o - r_i)$. For the apparatus shown in Fig. 4, the load will be about 4 times the weight of the drum.

Discussion of results

The climbing peel test, when properly conducted, has a number of desirable characteristics,

(*To page* 264)

Plastics Digest*

Abstracts from the world's literature of interest to those who make or use plastics or plastics products. For complete articles, send requests direct to publishers. List of addresses is at the end of Plastics Digest.

General

Radiation in the plastics industry. R. Roberts. Plastics (London) *21,* 116-17 (June 1956). The potential uses for radiation in the plastics industry are reviewed. These include the initiation of solid state polymerization, emulsion polymerization, graft polymerization, and the crosslinking of some polymers and elastomers.

Some newer plastics materials. E. M. Evans. Plastics Inst. Trans. and J. *24,* 199-212 (July 1956). Properties and applications of rubber resin blends, fibrous glass-reinforced polyesters, epoxy and silicone resins, internally-plasticized resins, irradiated plastics, polyethylene, phosphorus resin, fluorinated polymers, and an inorganic silicate are reviewed.

Materials

Vinyl epoxystearate: preparation, polymerization, and properties of polymers and copolymers. L. S. Silbert, Z. B. Jacobs, W. E. Palm, L. P. Witnauer, W. S. Port, and D. Swern. J. Polymer Sci. *21,* 161-73 (Aug. 1956). Vinyl epoxystearate was synthesized by the reaction of vinyl oleate and percarboxylic acids. An investigation of the kinetics of the epoxidation of the two unsaturated bonds in vinyl oleate shows that the epoxidation of the internal double bond proceeds at 220 times the rate of the vinyl bond. Polyvinyl epoxystearate was prepared by conventional methods. Like polyvinyl esters of other long-chain fatty acids, polyvinyl epoxystearate exhibits low intrinsic and specific viscosities. The mechanical and thermal properties of copolymers of vinyl chloride and vinyl epoxystearate were compared with those of compositions of polyvinyl chloride and butyl epoxystearate. Vinyl epoxystearate has a greater effect on the milling temperature of the copolymer than butyl epoxystearate has on that of the composition, but the opposite effect is observed on the temperature coefficient of the torsional modulus. In heat and light stability studies, it was found that butyl epoxystearate (or other external epoxy plasticizers) is more efficient than vinyl epoxystearate.

Resins for reinforced plastics. E. Schlieben. Product Eng. *27,* 198-203 (May 1956). The resins used in the field of reinforced plastics fall into five major classes: polyesters, polyesters with triallyl cyanurate (heat resistant), low pressure phenolics (heat resistant), silicones, and epoxys. These five classes of resins are evaluated for processing characteristics, mechanical and electrical properties, appearance, cost, advantages and limitations. The polyesters compare favorably in almost all respects to other types of resins for reinforced plastics applications; they are economical, easy to use, and have good physical, electrical, and structural properties. The silicones fail in many respects but are used for high temperature applications. Phenolics also have high temperature characteristics and are low in price, but they require further development work because of processing and molding difficulties. Epoxys show great promise for structural use although they are expensive; they wet reinforcement materials well, shrink very little during cure, and are resistant to strong chemicals. At present, the epoxys will not stand high temperatures, but developments underway will probably improve their temperature resistance characteristics.

Linear polyethylene. W. C. Goggin, G. B. Thayer, and G. W. Cheney, Canadian Plastics *1956,* 42, 44, 48, 50 (Apr.). The structure and properties of the new "linear" polyethylene are compared with that of the older "high pressure" polyethylene and with polystyrene. Although the new linear polyethylene is difficult to produce and presents stabilization and fabrication problems, it is a significantly different material from the older branched polyethylene, possessing greater stiffness, yield strength, heat resistance, and chemical resistance. It has excellent low temperature toughness. Low base material and fabrication cost should make possible inexpensive moldings from linear polyethylene.

Molding and fabricating

Injection molding research—today and tomorrow. J. Eveland, H. J. Karam, and C. E. Beyer. SPE J. *12,* 30-35 (May 1956). The literature on injection molding research is reviewed and vacancies in the system are discussed, in the order of progress of the plastic through the injection molding machine. The topics are: method of feeding material into the heating cylinder; effect of granule size, shape, and treatment; nonfluid zone; fluid zone; nozzles; and molds. Extensive bibliography.

Shock curing of some laminated materials. C. A. Redfarn and J. Bedford. Brit. Plastics *29,* 171-75 (May 1956). The development work being done on the "shock curing" method of curing plastic laminates is reviewed. This method consists essentially of applying a low-voltage current to a laminated material held under low pressure at a temperature of the order of 100° C. and greatly reduces the curing time. Consideration of the method indicates that the following points are necessary to accomplish shock curing successfully: the material must be capable of conducting an electric current at reasonably low voltages and at temperatures of

*Reg. U.S. Pat. Off.

the order of 100° C.; it must have a high breakdown temperature because temperatures in excess of 250° C. may be produced; current densities of at least 0.2 amp./sq. in. must be obtained; the material should be slightly dampened to improve its conductivity. The higher the voltage used, the quicker the cure time; DC and AC are equally effective; moldings of fairly complicated shape may be produced; wave curing can be accomplished, removing the necessity for platen heating.

A new measure of plastic moldability. D. B. Semeyn. SPE J. *12*, 15-17 (May 1956). To arrive at a moldability rating for plastic materials, a test part was designed that would be difficult but possible to mold. To ascertain the cylinder temperature and injection pressure combination limits to mold a material, a molding area diagram is developed for this test mold. To find the speed with which a material may be molded and to determine the quality of molded parts, a minimum cycle for producing satisfactory parts is found in a systematic manner. The molding area diagram is reduced to a number which represents the size and location of the molding area. This is combined with the minimum cycle time to give a numerical moldability rating.

Applications

Plastic springs. F. W. Reinhart and S. B. Newman. Product Eng. 27, 183-86 (June 1956). Helical plastic springs with coil diameters of approximately 1-in. and wire diameters of 3/16 in. were formed from fibrous glass-reinforced epoxy resins cured with *m*-phenylenediamine. A spring of this type, 2 in. tall, deflected ½-in. under a static load of 25 lb. Springs 3 in. tall, compressed to their solid length and stored at 135° F. for 13 days, retained over 5 in.-lb. of energy at the end of the storage period. After 30 days storage at this temperature residual energies of at least 30% of the original should be obtained. Substantial improvement in recoverable energy properties of springs was obtained by preloading before use. These fibrous glass-reinforced plastic springs had torsional moduli of rigidity of the order of 1.0 x 10^6 p.s.i. The springs were molded by drawing resin-soaked fibrous glass rovings through vinyl chloride-vinyl acetate copolymer tubing and wrapping the loaded tubing in a helix around mandrels of suitable diameter. Mandrel and tubing were transferred to an air circulating oven for curing. The tubing was subsequently removed. A large number of commercial formulations were screened in order to eliminate resins with unsuitable properties. Tests of resin rods permitted a rapid evaluation of torsional rigidity and temperature sensitivity. In general, the polyesters were more sensitive to elevated temperatures than the epoxy resins but the epoxy materials varied widely in this respect. Results obtained in this work and elsewhere indicate that polyester and epoxy resins are most promising for spring applications on the basis of torsional moduli and temperature sensitivity.

Polyvinyl alcohol foam for artery grafting. K. Owen. Brit. Plastics *29*, 212-14 (June 1956). Tubes made from polyvinyl alcohol foam are being used to replace sections of arteries in the human body. The tubes are made by cutting strips of the foam 3 cm. wide and 2-3 mm. thick, winding them around a metal or glass rod, overwrapping with a cotton bandage, and boiling in water for 20 minutes. The bandage and the mandrel are then removed.

Heat-processible food films. A. I. Nelson, K. H. Hu, and M. P. Steinberg. Modern Packaging *29*, 173-79, 248, 250, 251 (June 1956). The suitability of several types of heat-resistant plastic film for use in packaging heat-processed foods was investigated. Pliofilm, polyethylene, and cellophane deteriorated when subjected to 250° F. for 30 minutes. Tygon, vinyl blood pack, and Saran were eliminated in organoleptic tests using boiling water. Teflon was eliminated because of difficulty in heat sealing. Of the two remaining films, Trithene (polymonochlorotrifluoroethylene) has a much lower water-vapor permeability than Mylar and in both cases the permeability increased after exposure to 250° F. for 30 minutes. The permeability of both films to oxygen, carbon dioxide, and organic vapors was low and remained so after exposure to 250° F. The packaging of several specific foods was studied.

Properties

Long term strengths of reinforced epoxy pipe. H. D. Boggs. Plastics Tech. *2*, 459-62 (July 1956). The results of long term burst tests on plastic pipe are presented.

Thermal expansion of polytetrafluoroethylene (Teflon) from −190° to +300° C. R. K. Kirby. J. Research Nat. Bur. Standards 57, 91-4 (Aug. 1956). The linear thermal expansion of four samples of Teflon was determined. The results for annealed Teflon are indicated in a plot of the expansion versus temperature and in a table listing the average coefficients of linear expansion from −190° to +300° C. The effect of internal residual stresses on the expansion of Teflon was studied and found to be considerable. The first-order transitions at 20° and 30° C. are clearly shown in a plot of the coefficients of expansion versus temperature.

Thermosetting moldings in the tropics. Brit. Plastics *29*, 224 (June 1956). Two British reports on the effects of tropical exposure on aminoplastic and phenolic moldings are reviewed. Two urea resins, two melamine resins, one aniline-formaldehyde resin, and twelve phenolic resins containing various fillers were exposed in both humid and dry tropic conditions up to 18 months. Tests were conducted to determine the change in appearance, support of mold growth, electrical properties, changes in weight and dimensions, warping, and corrosion of brass inserts. In all cases, the specimens exposed out of doors lost their gloss and discolored when exposed to sun and rain. Biological growths were evident on most specimens exposed in the jungle. Corrosion occurred on the inserts of all specimens exposed in the open, but in no case was

Telephone finger wheel molded of transparent PLEXIGLAS is smooth and warm to the touch, adds jewel-like sparkle to instrument.

Metallized on its second surface, this molded PLEXIGLAS cover for a wall-mount faucet is gleaming in appearance, durable and easily cleaned.

Housing of compact-size electric shaver for women is molded of PLEXIGLAS in six lustrous fashion colors . . . turquoise, ivory, pink, blue, coral, black.

Designed with PLEXIGLAS in mind

When PLEXIGLAS® acrylic plastic is used to impart both eye-catching attractiveness and long-term serviceability, a product has a head start to sales success. Here are the reasons more and more manufacturers, designers and molders are turning to PLEXIGLAS to gain a competitive advantage:

- brilliant colors that stay fresh for years
- crystal clarity that gives depth and sparkle to back-surface paints and metallized coatings
- excellent resistance to impact, weather, discoloration
- optical properties that make possible new designs in edge-lighted moldings
- ability to be molded accurately into complex shapes

Our technical representatives and Design Laboratory staff would like to show you how PLEXIGLAS can solve specific problems involving molded plastic parts.

Chemicals for Industry

ROHM & HAAS COMPANY

WASHINGTON SQUARE, PHILADELPHIA 5, PA.

Representatives in principal foreign countries

Canadian Distributor: *Crystal Glass & Plastics, Ltd., 130 Queen's Quay at Jarvis Street, Toronto, Canada.*

there a deleterious effect on the plastic material. Warping occurred on some specimens at all sites. Specimens exposed to humid conditions showed an increase in weight and dimensions, decrease in volume and surface resistivity, and increase in power and permittivity. The reverse was true for specimens exposed to semi-desert conditions.

Testing

Determination of resin content of glass fiber-polyester laminates containing calcium carbonate filler. S. D. Toner. Analytical Chem. *28,* 1109-12 (July 1956). A reasonably accurate determination of resin content of fibrous glass-polyester laminates containing calcium carbonate filler may be made by following the normal procedure for resin content. The values obtained upon ignition are then corrected by treating the ignited residue with ammonium carbonate to convert any reduced calcium oxide back to the carbonate. A quantitative measurement of calcium carbonate cannot be made by treatment of the ignited residue with hydrochloric acid because certain constituents of the glass are dissolved by the acid.

Polymer characterization: A typical copolyamide system. R. G. Beaman and F. B. Cramer. J. Polymer Sci. *21,* 223-35 (Aug. 1956). A characterization scheme for small-scale evaluations of fiber-forming polymers is presented. Tests are described for bulk polymer (visual observation, toughness, viscosity number, polymer melt temperature, and solubility), films (visual observation, toughness, water absorption, glassy transition temperature, and crystallinity), and fibers (tenacity, elongation, initial modulus, compliance ratio, tensile recovery, work recovery, fiber stick temperature, zero strength temperature, crystalline melting point, orientation, and crystallinity). The copolyamide system poly(tetramethylene adipamide-co-hexamethylene sebacamide) was evaluated over the whole composition range by this scheme. In general, maxima or minima were obtained at an intermediate composition for the properties studied. The point of greatest copolymer effect, however, was found to depend upon the specific property studied.

Publishers' Addresses

Analytical Chemistry: American Chemical Society, 1115 Sixteenth St., N. W. Washington 6, D. C.

British Plastics: Iliffe and Sons, Ltd., Dorset House, Stamford St., London S. E. 1, England.

Canadian Plastics: Monetary Times Printing Co., Ltd., 341 Church St., Toronto 2, Ontario, Canada.

Journal of Polymer Science: Interscience Publishers, Inc., 250 Fifth Ave., New York 1, N. Y.

Journal of Research of the National Bureau of Standards: Superintendent of Documents, Government Printing Office, Washington 25, D. C.

Modern Packaging: Modern Packaging Corp., 575 Madison Ave., New York 22, N. Y.

Plastics (London): Temple Press Ltd., Bowling Greene Lane, London E. C. 1, England.

Plastics Institute Transactions and Journal: The Plastics Institute, 6 Mandeville Place, London, W. 1, England.

Plastics Technology: Bill Brothers Publishing Corp., 386 Fourth Ave., New York 16, N. Y.

Product Engineering: McGraw-Hill Publishing Co., 330 W. 42nd St., New York 18, N. Y.

SPE Journal: Society of Plastics Engineers, Inc., 513 Security Bank Bldg., Athens, Ohio.

U.S. Plastics Patents

Copies of these patents are available from the U.S. Patent Office, Washington, D. C., at 25¢ each

Styrene resins. A. H. Bowen (to Monsanto). U. S. 2,757,153, July 31. Water-soluble styrene-maleic anhydride derivatives.

Resins. R. H. Sudekum (to Du Pont). U. S. 2,757,155, July 31. Stabilized chlorosulfonated hydrocarbon polymers.

Polyamides. J. Dazzi (to Monsanto). U. S. 2,757,156, July 31. Plasticizing polyamides with N-alkyl alkane sulfonamides.

Polymers. S. J. Hetzel (to Sun Oil). U. S. 2,757,157, July 31. Esters of pentanediols as plasticizers for vinyl polymers.

Polyesters. J. R. Darby and A. R. Hempel (to Monsanto). U. S. 2,757,-158, July 31. Polyester resins.

Molding composition. T. F. Anderson (to Allied Chemical). U. S. 2,757,160, July 31. Unsaturated alkyd molding compositions.

Stabilizer. G. H. Bowers (to Du Pont). U. S. 2,757,163, July 31. Stabilization of chlorosulfonated polymers with salicylalazine.

Resins. H. S. Bloch and R. B. Thompson (to Universal Oil Products). U. S. 2,757,164, July 31. Resins from keto-amides.

Terpolymers. R. J. Slocombe (to Monsanto). U. S. 2,757,165, July 31. Vinyl acetate-acrylonitrile-styrene terpolymers.

Polymers. G. D. Jones and R. L. Zimmerman (to Dow). U. S. 2,757,-190, July 31. Polyvinylisothiocyanate.

Molding. E. E. Montross (to Polymer). U. S. 2,757,416, August 7. Molding nylon.

Resins. H. M. Shappell (to Carbide and Carbon). U. S. 2,758,101, August 7. Water soluble phenolic resins.

Polymer. F. P. Alles and W. R. Saner (to Du Pont). U. S. 2,758,105, August 7. Polyalkylene terephthalates.

Plastic construction. J. W. Westfall (to Anchorage Plastics). U. S. 2,758,321, August 14. Reinforced plastic construction.

Extrusion. J. Allan, K. E. Wright, and B. Shaw (to British Celanese). U. S. 2,758,339, August 14. Extrusion of cellulose acetate.

Coating. E. Simon and F. W. Thomas (to Lockheed). U. S. 2,758,-948, August 14. Light transparent electrically conducting coating.

Reinforced plastic. J. W. Case. U. S. 2,758,951, August 14. Reinforced plastic bodies.

Stabilizers. J. E. Wicklatz and J. F. Howe (to Phillips). U. S. 2,758,-982, August 14. Amides as stabilizers for polysulfone resins.

Plastic. M. A. Coler. U. S. 2,758,-984, August 14. Destacticized plastics.

Resin. D. E. Strain (to Du Pont). U. S. 2,758,985, August 14. Polycarbonamides stabilized with dicyandiamide.

Resins. W. D. Mecum (to American Brake Shoe). U. S. 2,758,986, August 14. Cardanolalkylene oxide resins cross-linked with dicarboxylic acids.

Polymers. P. L. Salzberg (to Du Pont). U. S. 2,758,987, August 14. Optically active polymers.

Polymers. F. W. Banes, J. F. Nelson, and H. K. Wiese (to Esso Research). U. S. 2,758,988, August 14. Petroleum resins.

Polymerization. M. J. Maue (to M. W. Kellogg). U. S. 2,758,989, August 14. Polymerization of cyclooctatetraene.

Resins. P. Lipsitz (to Du Pont). U. S. 2,758,990, August 14. Alkali lignin condensed with polyhydroxy benzene.

Polymerization. M. L. Dunham, Jr. and G. H. Wagner (to Carbide and Carbon). U. S. 2,759,006-7-8, August 14. High pressure polymerizations.

Cellulose esters. G. P. Toney and J. E. Kiefer (to Eastman Kodak). U. S. 2,759,787, Aug. 21. Cellulose citrates.

Coatings. J. R. Caldwell and R. Gilkey (to Eastman Kodak). U. S. 2,759,900, Aug. 21. Polyacrylate textile coatings.

Resins. S. O. Greenlee (to Devoe and Raynolds). U. S. 2,759,901, Aug. 21. Partial epoxide resin esters.

Soil conditioning. F. C. Magnussen and A. J. Martinelli (to General Aniline). U. S. 2,759,902, Aug. 21. Soil-conditioning resins.

Elastomers. T. D. Talcott (to Dow Corning). U. S. 2,759,904, Aug. 21. Organosilicon elastomers.

Stabilizers. E. H. Wood and J. R. Wilkinson (to Carbide and Carbon). U. S. 2,759,905, Aug. 21. Stabilizers for polystyrene.

Resins. W. E. Leistner and A. C. Hecker (to Argus Chemical). U. S. 2,759,906, Aug. 21. Vinyl chloride resin stabilized with a tin compound.

Resins. O. Albrecht (to Ciba). U. S. 2,759,907, Aug. 21. Condensates of guanylmelamine and an aldehyde.

Polymers. G. F. D'Alelio (to Koppers). U. S. 2,759,908, Aug. 21. Polymers of N-pyrimidyl itaconic amides.

Resins. G. D. Hiatt and J. Emerson (to Eastman Kodak). U. S. 2,759,909, Aug. 21. Polyvinyl dicarboxylic acid esters.

Polymers. J. N. Milne and R. G. D. Crick (to Distillers). U. S. 2,759,910, Aug. 21. Interpolymers of unsaturated acids and nitriles.

Resins. H. W. Coover, Jr. and J. B. Dickey (to Eastman Kodak). U. S. 2,759,912, Aug. 21. Polymers of allyl esters of trifluoroacetic acid.

Polymers. G. E. Hulse (to Hercules). U. S. 2,759,913, Aug. 21. Copolymers of alkylenebis-acrylamide and piperazine.

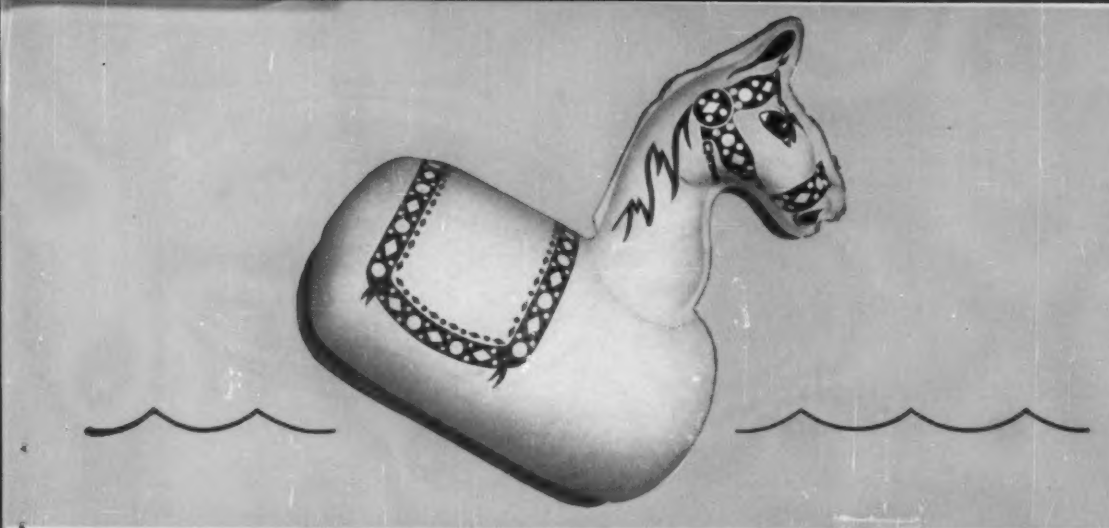
Molding. J. Bjorksten. U. S. 2,760,-233, Aug. 28. Forming curved plastic sheets.

Tote box. A. W. Knieriem and L. C. Folst (to Calresin). U. S. 2,760,676, Aug. 28. Molded plastic tote box.

Photographic relief images. L. Plambeck, Jr. (to Du Pont). U. S. 2,760,863, Aug. 28. Photopolymerization to produce relief images.

Tile. H. A. Toulmin, Jr. (to Commonwealth Engineering). U. S. 2,760,-881, Aug. 28. Ceramic tile from resin-bonded fibrous glass structures.

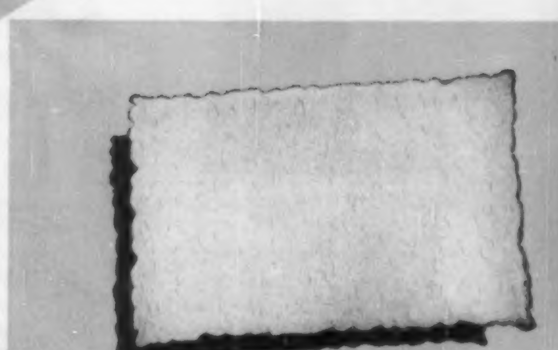
Sheet. G. L. Graf, Jr. (to Celastic).



For long-lasting whiteness, specify easily dispersible

UNITANE® OR-342

RUTILE TITANIUM DIOXIDE



Whiteness, brightness and opacity, stability to heat and light, freedom from hard-to-disperse clusters—all of these combine to make UNITANE OR-342 rutile titanium dioxide the white pigment choice in high-quality plastics.

UNITANE OR-342 is carefully processed and check-tested to maintain soft texture and easy dispersion—a quality you must have for perfect polyvinyl sheeting; a quality that means economy in all plastics compounding.

Advertisers, Take Note!

The March issue of Modern Plastics will be a particularly important one—a truly "special" issue for suppliers to the plastics market who are aiming to build sales on the West Coast.

Here's why. *Two* events of major significance to the plastics field will be staged concurrently in Los Angeles in March: The 1957 SPI Annual Conference and the First Pacific Coast Plastics Exposition. Both are sponsored by The Society of the Plastics Industry.

Editorially, Modern Plastics will go "all out" in characteristically thorough fashion to tie in with these events. Feature articles will deal with Pacific Coast plastics developments. There will be detailed exhibit diagrams, schedules of events, attendance rosters.

Circulation-wise, the March issue will provide selective *added* distribution to cover whatever leading plastics-consuming firms on the West Coast that the magazine does not normally reach.

Timing of the issue will be just about ideal. Copies will be mailed to each subscriber before the end of February so that those who intend to go to Los Angeles can use it as an advance guide to both events.

Lowered advertising rates will be in effect for companies electing to limit their advertising to West Coast readers. Regular rates, of course, will apply to advertisers aiming to reach Modern Plastics' full circulation.

For full details write today to
Advertising Director,

MODERN PLASTICS
575 Madison Ave., New York 22, N. Y.

U. S. 2,760,884, Aug. 28. Sheet material impregnated with resins.

Laminates. F. F. Koblitz and J. G. Hilden (to Bjorksten Research). U. S. 2,760,893, Aug. 28. Transparent laminates of glass sheets and siloxane resin binder.

Panels. E. H. Voelker (to Republic Aviation). U. S. 2,760,898, Aug. 28. Reinforced resin panels.

Coating. N. B. Oakley (to Hercules). U. S. 2,760,942, Aug. 28. Heat-sealable coating.

Resins. S. O. Greelee (to Devoe and Raynolds). U. S. 2,760,944, Aug. 28. Aminoamide-epoxy compositions.

Polymer. T. E. Workema, J. W. Thorsber, and C. E. DeLong (to Dow). U. S. 2,760,947, Aug. 28. Self-extinguishing alkenyl polymer compositions containing bromo-chloro compounds.

Polyesters. E. W. Moffett and E. E. Parker (to Pittsburgh Plate Glass). U. S. 2,760,948, Aug. 28. Polyester resins.

Polymers. G. W. Stanton and F. A. Ehlers (to Dow). U. S. 2,760,950, Aug. 28. Stabilized acrylonitrile polymers.

Resins. H. F. Park and R. J. Anderson (to Monsanto). U. S. 2,760,951, Aug. 28. Resinous nitromethane reaction products.

Polymers. W. Grimme and J. Wollner (to Rheinpreussen Akt.) U. S. 2,760,952, Aug. 28. Polymers of 2-hydroxymethyl-butene-1-one-3.

Resins. N. V. Seeger (to Goodyear). U. S. 2,760,953, Aug. 28. Polyesters reacted with tolylene diisocyanate.

Copolymers. M. A. Naylor, Jr. (to Du Pont). U. S. 2,760,954, Aug. 28. Interpolymers of 1,2-dimethoxyethylene and maleic anhydride.

Copolymers. H. F. Park and R. M. Dickey (to Monsanto). U. S. 2,760,-955, Aug. 28. Vinyl sulfonamide-acrylonitrile copolymers.

Containers. F. C. Gossett (to Don Baxter). U. S. 2,761,264, Sept. 4. Apparatus for forming, filling, and sealing plastic containers.

Preforms. R. Lindenfelser and M. K. Kilthan (to American Cyanamid). U. S. 2,761,779, Sept. 4. Pulp preforms impregnated with a thermosetting resin.

Plastic. R. G. Rowe and G. Flower, Jr. (to Dictaphone). U. S. 2,761,787, Sept. 4. Plastic having antistatic properties.

New Machinery and Equipment*

Mold bases

DME 611-C and 1315-C are standard mold bases particularly designed for the new Stokes compression presses, the 15-ton Model 800 and the 50-ton Model 741 respectively. All cavity plates in these bases are ground flat and square, permitting the moldmaker to lay out the cavities without any preliminary machining. The 611-C is 10.9 in. long by 6 in. wide, with heights ranging from 14.2 to 15.8, depending on the thickness of the cavity plates. The corresponding dimensions of the larger model are 13 by 15 by 17.2 to 21.2 inches. Both bases are designed to give maximum usable cavity area, have built-in clamp slots to fit the Stokes presses, and are available in two different steels. (Engineers from six prominent machinery and molding companies assisted in the design of these mold bases.) *Detroit Mold Engineering Co., 6686 E. McNichols Rd., Detroit 12, Mich.*

Mooney viscometer

Model STI is a completely redesigned Mooney viscometer featuring new ease of operation and maintenance, improved stability of operating conditions, and added safety features. It is pneumatically closed with high and low pressures and has a vertical and square drive shaft (eliminating the key of the old model); the driving section of the new rotor shaft is also square. The platens are now made of aluminum and redesigned for easy removal and cleaning. The heating system gives better control and higher temperatures, up to 400° F. The measuring system contains a new thrust bearing and a knife-edge integral with the horizontal shaft, thus simplifying calibration and insuring steady dial readings. The new instrument has one thing in common with the old: the basic "Mooney Values" obtained. *Scott Testers, Inc., 96 Blackstone St., Providence, R. I.*

"Printed" holes in plastics

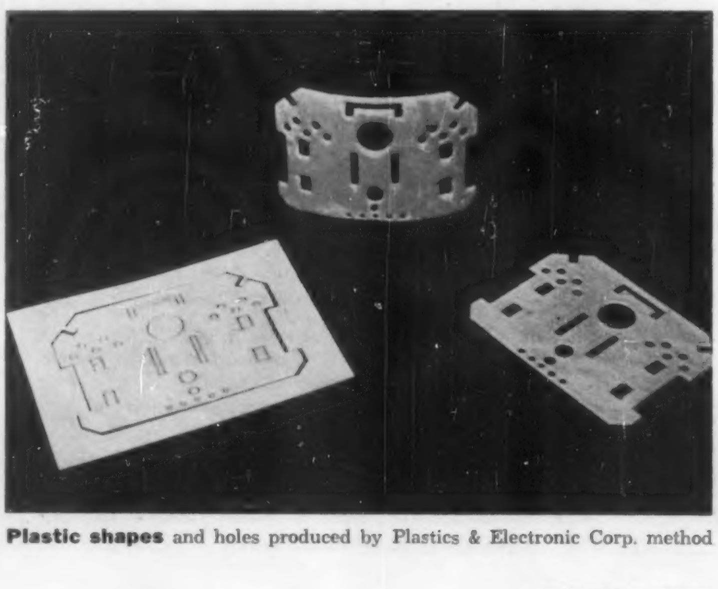
In an unusual approach to producing plastic shapes and holes in plastics, partially cured resin is applied to a carrier sheet in the desired thickness and the coated sheet is then placed in an ordinary letterpress. There it is "printed" by a deeply etched printing plate (the inking rolls are not used), which leaves a deep impression of the desired design in the resin. When the resin has been cured, the center cores and flash are easily removed by air blasting or tumbling. Materials successfully processed to date include epoxies, polyesters, and plastisols, with and without fillers and pigments. The new process is expected to be useful in making flat or curved printed circuits, electrical panels, nameplates, gears, etc. To be licensed by *Plastics and Electronics Corp., 272 Northland Ave., Buffalo 8, N. Y.*

Cold-curing compound for flexible molds

Poly-Flex 100, a polymer-based mold compound in liquid form, has been developed for making flexible molds over plaster, wood, metal, clay, or wax patterns. The resin is mixed with a curing agent to give a low-viscosity liquid that molds very faithfully and cures in about 4 hr. at room temperature. The cured resin ages well, is resistant to solvents and dilute solutions of chemicals, and will withstand intermittent service temperatures up to 200° F. *Smooth-On Mfg. Co., 572 Communipaw Ave., Jersey City 4, N. J.*

Beta-ray thickness gages

A new producer has entered the beta-ray gage field with a line of five Atom-At gages: a transmission gage for paper, foils, plastic films, etc.; a backscatter gage for coatings accessible from one side only; a differential gage for coated films; a multi-head gage for wide webs of coated films; and a transverse profile portable gage that measures thickness across the whole width of a sheet. The firm states that, by using



Plastic shapes and holes produced by Plastics & Electronic Corp. method

*Specifications and claims made and appearing in these pages are those of the manufacturers of the machinery and equipment described and are not guaranteed by MODERN PLASTICS.

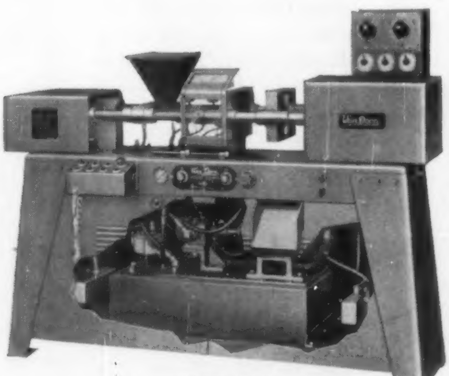
Profitable Plastics Production with...

VAN DORN EQUIPMENT

AUTOMATIC OPERATION AT LOW COST

This high speed 2½ oz. injection press plasticizes material at 22 lbs. plus per hour, and attains up to 1200 cycles per hour (dry run). High efficiency due to *water cooled* plunger, transfer hopper, and oil cooler. Accessible platen clamp device insures easy purging to change material. For safety, press will not operate unless part is fully ejected. Simple operation due to automatic, adjustable material metering device. Press requires little attention during production. May also be operated semi-automatically. All steel construction.

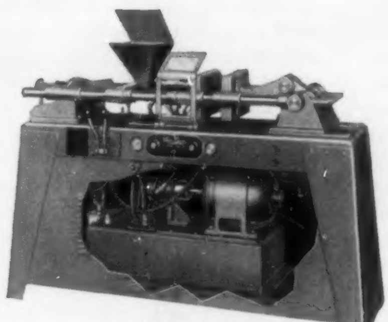
MODEL H-250



MODEL H-200

SEMI-AUTOMATIC 2 OZ. PRESS

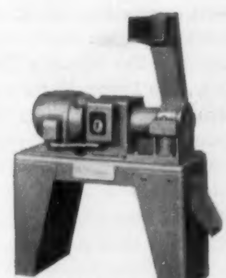
Up to 10 cycles per minute. Safe, simple push button controls. Accurate temperature regulation. Rugged, compact, quiet.



MODEL H-200

POWER OPERATED, LEVER CONTROLLED PRESSES

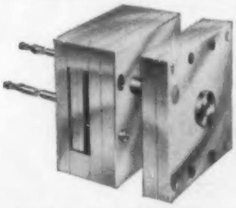
2 oz. or 1 oz. Operate 8 hours for under a dollar and use inexpensive molds. Easily set up in twenty minutes.



MODEL G-100

PLASTIC GRINDER

Grinds up rejects, waste, etc., for re-use. Ruggedly made, designed for easy cleaning.



MOLD BASES

Available from stock for all Van Dorn presses.

THE *Van Dorn* IRON WORKS CO.
2687 EAST 79th STREET • CLEVELAND 4, OHIO
TELEPHONE: EN. 1-5234

Write for Bulletins...Financing Available

foot-wide samples, the profiles of all the lines in a plant can be rapidly recorded with a single transverse profile gage. The measurable range of thicknesses covers all normal manufacturing needs, and accuracy is said to be within ±1% of the nominal thickness. Dials are calibrated in any desired units. *Nuclear Corp. of America, Inc., Empire State Building, New York 1, N. Y.*

Inserts and studs

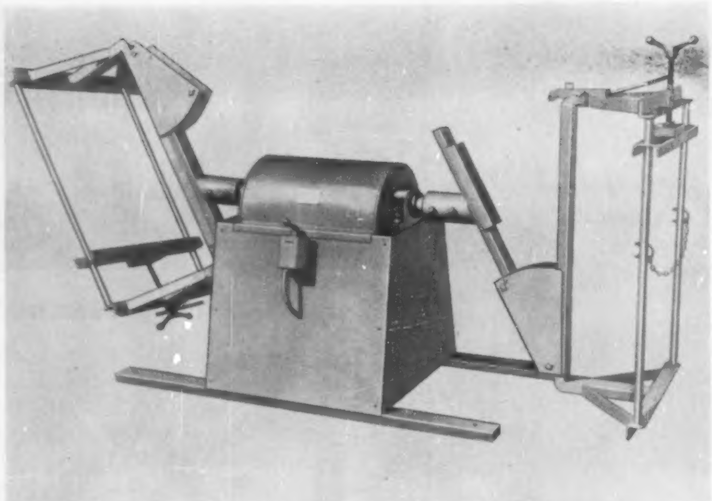
A new line of threaded inserts and studs are designed to be molded into plastics products. Both the inserts and studs have two ruggedly knurled bands divided by deeply cut rings to give them high holding strength in moldings. They are available in all regular thread sizes from No. 2 to ⅜-in., both N.C. and N.F. Class 2 threads are standard, but Class 3 are available to order. The inserts are made in two series: tapped straight through, and blind; they are free of chips. Stocked in brass, they will be made to order from steel, aluminum, or stainless. *Standard Insert Co., 12270 Montague St., Pacoima, Calif.*

Machine postforms laminates

Model 1009 Incrematic postforming machine shapes flat sheets of laminates up to 10 ft. long to follow the contours of coved backs or raised edges. Used in conjunction with the maker's Thermofast press, the 1009 will turn out fully formed sink tops on a 6-min. cycle. Since the postformed shape is cured into the sheet, the laminates must contain only partly cured resins. Springback is controlled so that no restraint is required during cooling. *The Grace Fabri-Tool Co., 1238 Chase Ave., Cincinnati 23, Ohio.*

Double drum tumbler

Featuring floor-level loading, a heavy-duty drum tumbler for dry blending is designed for long life under the stresses set up by as much as 300 lb. of material in each drum. Built extra-heavy throughout, with ball bearings instead of the usual journal or sleeve bearings, it handles its workload easily with only a ½ h.p. motor. It is rugged enough so that an unbalanced load of only one drum can't hurt it. The tumbler is wired with a reversing-type switch for jogging the barrels to the loading-unloading position, near the floor and upright, where they are easily and safely slipped onto hand trucks. A wide range of drum sizes can be handled. *Rainco Mfg., Inc., Oil City Rd., Franklin, Pa.*



Rainco tumbler for dry blending is loaded at floor level and safely handles unbalanced load of one drum

Steel for molds

Moldtem, a new mold and die steel, is a chromium-molybdenum-vanadium alloy that comes prehardened and ready for use without further heat treatment. The hardness ranges from 302 to 341 Brinell. Moldtem is claimed to have maximum polishability and is easy to machine. A combination of chemical composition and careful quality control helps to eliminate the tiny pit-producing bubbles characteristic of many steels. These pits cannot be polished out or filled by plating. *Heppenstall Co., 4620 Hatfield St., Pittsburgh 1, Pa.*

Portable flocking machine

A flocking machine weighing only 80 lb. features, aside from its compactness, a tilting supply hopper that makes it easy to empty unused flock or to change quickly from one color to another. The machine has only two moving parts: a spark proof blower and a long-stroke magnetic-vibrator feed mechanism that is built into the feed hopper. The feeder is wired so that it cannot operate unless the blower is running, thus preventing overloading and clogging of the blower. Once-a-year cleaning is sufficient for both the totally enclosed motor and the feeder. The unit is used in conjunction with an adhesive spray gun: the operator can spray adhesive with one hand and apply flock with the other. *Progressive Equipment Co. (PECO), 8625 Mackinaw, Grand River, Detroit 4, Mich.*

Remodeled barrel finisher

The redesigned Model V-8 barrel finisher has its motor located at the rear of the machine where it is protected from splashing water. The solid metal guard has been replaced with a wire mesh guard, with a gain in visibility and ease of handling. The new finisher can use interchangeable barrels in capacities ranging from 2 to 8 cu. ft., and is powered by a 1.5-hp. motor with a jogging and reversing switch. Barrels are available with vinyl linings, if desired. *Rampe Mfg. Co., 14915 Woodworth Ave., Cleveland 10, Ohio.*

Compact desk-model sealer

A semi-automatic heat-sealer that seals unsupported plastic films (including polyethylene) and plastic coated sheeting is the

Product Packaging heat sealer Model 54UL has fibrous glass-reinforced Teflon facing pad

Model 54UL. It uses an electrically heated platen and a clamping pad faced with fibrous glass reinforced Teflon. Preset dials govern the heating and dwell cycles, while an electronic timer controls an electro-mechanical lock that maintains pressure on the locked jaws of the pressure platen. Jaw opening is ¾ in., platen width is 14 in., weight is 20 pounds. *Product Packaging Engineering, 5747 Marilyn Ave., Culver City, Calif.*

Dispersion mills

A new principle in the design of ball mills cuts milling time by as much as a factor of 10. In the new mills, four individual pots are arranged on the periphery of a circle that revolves around a central drive while each pot also rotates simultaneously on its own driving spindle. The result is a greatly multiplied mixing action and the subjection of a greater amount of the pigment (for example) and the liquid to the grinding action of the balls or pebbles. Both a production and a laboratory model are available. In the former, the pot capacity is 6 gal., while the lab. model has 3-pt. pots. *Kinetic Dispersion Corp., 95 Botsford Pl., Buffalo 16, N. Y.*

Parts washer

Small plastics parts can be spray-washed safely and economically in bulk by means of a compact rotary-drum, batch-type machine. Batches are introduced into the machine through a feed chute; the parts are tumbled gently and exposed to fan-shaped spray nozzles inside the drum, then discharged through a second chute. Drums are made for any desired batch capacity but a volume of 2 cu. ft. has been found ample for most operations. The cleaning solution can be heated with any convenient heat source. Because the parts are warm as they leave the drum, they flash-dry quickly. Washing rates are up to 20 cu. ft./hr. *The Alvey-Ferguson Co., Disney St., Cincinnati 9, Ohio.*

Bench-type coater

This compact coater is designed to coat sheet materials such as plastics, plywood, fabrics, etc., up to 1.5 in. thick, with paint, adhesives, and so on. Several models are available: there are single top coaters, bottom coaters, and two double styles in lengths from 8 to 52 inches. A uniform-thickness coating can be applied at rates up to 3800 linear ft./hr. Up to 850 sq. ft. can be covered per gal. of material. All rolls are power driven by a ¼-h.p. motor. Spring-loaded disks at the ends of the rolls confine the material to be coated to a reservoir area. Rubber rolls are available in neoprene, Hycar, or Thiokol. *L. R. Wallace & Co., 191 N. Pasadena Ave., Pasadena 3, Cal.*

Compression press

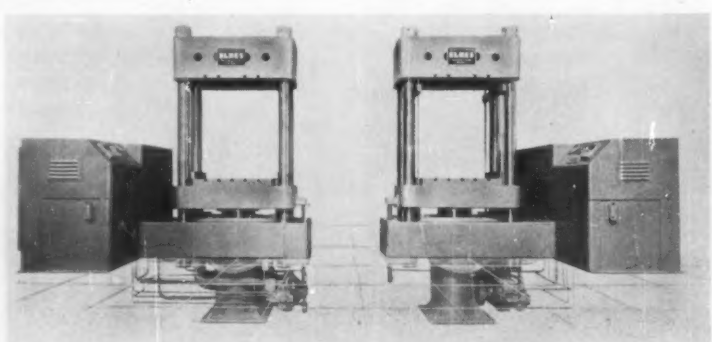
The Elmes 300-ton hydraulic compression press is especially designed for convenient use in pairs, two presses being run by a single operator. Available in right- and left-hand models, the press has a stroke of 18 in. and an operating pressure of 2640 p.s.i. The opening between platens is 44 in., and dies up to 36 by 30 in. can be accommodated. Operating speeds in in./min. are: advancing, 309; pressing, 15; and returning, 131. Provision has been made for the convenient addition of a heat-transfer unit if it is later desired. All the hydraulic and electrical components of the press are encased in a cabinet that keeps them free of dust, flash, etc. *American Steel Foundries, Elmes Engineering Div., 1150-B4 Tennessee Ave., Cincinnati 29, Ohio.*

Preheater for preforms

Model SE-2517 is a dielectric preheater with a 1-kw. output operating at 27 mc. on 115-v. A.C. It can accommodate preforms up to 6 in. square ranging from 0.5 to 2.5 in. in thickness. The preform draw slides on graphite bronze bearings for smooth, trouble-free operation. Accurate control of the heating time is assured by a cycle flex timer. The unit is completely shielded and meets J.I.C. standards for heavy-duty industrial service. *Scientific Electric Co., 117 Monroe St., Garfield, N.J.*

Non-stick laminating rolls

A tough silicone rubber roll covering, called Rolease, eliminates the sticking of extruded film to laminating rollers. This makes possible the extrusion of laminating film wider than the paper to which it is laminated, instead of vice versa. The excess film can be trimmed off and re-used, whereas excess paper could not. The new roll covering also has excellent heat resistance, and has successfully withstood repeated application of nip loads up to 100 lb. without flow. According to the maker, much of the success of the



Elmes 300-ton compression presses can be run in pairs by one operator

ond chute. Drums are made for **Elmes** 300-ton compression presses can be run in pairs by one operator

Rolease cover is due to the special combination of properties possessed by Union Carbide's new silicone rubber from which it is made. *Stowe-Woodward, Inc., Newton Upper Falls, Mass.*

Small utility ovens

A new line of ovens for small-batch drying, curing, testing, etc., have about 2- by 2- by 2-ft. interiors but vary in their temperature ranges from 100 to 1000° C. A forced-air recirculating system with controlled intake and exhaust vents and fan is built in. The shielded heating elements of these ovens cannot overheat the oven contents by radiation, and they give more even temperature control throughout the oven volume. They are made to operate at 110 and 220 v., but can be changed to be used with any non-standard electrical supply. *New England Oven and Furnace Co., Orange, Conn.*

Combination bag maker, printer

Kleina Rotoplast is a machine that can make flat or gusseted plastic bags from blown tubing and print them in two colors, at a speed up to 1900 per hour. Sealing is done by an electrically heated strip sealing device. The machine is available with or without the printing units in two models. Model 30 handles bags up to 12 in. wide in lengths ranging from 6 to 31 in., while Model 50 makes and prints bags up to 20 in. wide in the same length range. *G. Bielloni, Via Pergolesi 15, Milan, Italy.*

Teflon thread-sealing compound

T-film is a Teflon-containing paste that can be smeared on pipe threads, bolt threads, etc., to give a resilient, seize-proof seal that can be disassembled and reassembled many times without loss of sealing quality. The compound has the chemical and heat resistance of Teflon and can be used under the same service conditions as that material. It is said to have enough resilience to maintain the seal in spite of joint expansion and contraction. *Eco Engineering Co., 12 New York Ave., Newark 5, N. J.*

Books & Booklets

Write for these publications to the companies listed. Unless otherwise specified, they will be sent gratis to executives who request them on business stationery.

"Polyurethanes"

By Austin C. Beutel et al.
Published (in mimeographed form) in 1956 by Polyurethane Associates, P. O. Box 98, Cambridge 38, Mass. 115 pages. Price: $10.

This report is an integrated analysis of the various aspects of polyurethanes, including technical, production, and marketing information. The factual information was collected from publications, interviews, and correspondence with producers and suppliers connected with polyurethanes. It reviews the developments and progress which have already taken place, and projects, wherever possible, the market potentials for polyurethanes. It includes descriptions of manufacturing procedure, estimates of required capitalization, and projections of costs, selling prices, and profitability. Markets are divided into four classes, discussed individually: 1) flexible foam, 2) rigid foam, 3) urethane rubber, and 4) coatings, adhesives, etc.

"Vacuum Deposition of Thin Films"

By L. Holland
Published in 1956 by John Wiley & Sons, Inc. 440 Fourth Ave., New York, N.Y. 541 pages—25 plates. Price: $10.

The author of this valuable text on vacuum deposition is the head of the Vacuum Coating Research Laboratory of Edwards High Vacuum Ltd., and has been publishing in the field for at least eleven years. Both vacuum evaporation and cathodic sputtering are covered. While the main emphasis is rightly on the deposition of metals, the deposition of carbon, metal oxides, and alkaline earth fluorides as optical interference films, is also covered. Considerable attention is given to high vacuum equipment, preparation of surfaces, vapor sources, film characteristics and their dependence on deposition conditions, and evaporation techniques. Two chapters are devoted entirely to the degassing of plastics in vacuum and to the evaporation of films onto plastics. There are 557 references through 1955, a handy appendix summarizing the deposition characteristics of different materials, and indexes. While the author does not hesitate to introduce theory where it is needed, the book is primarily a handbook of deposition technology.

"Industrial Engineering Handbook"

Edited by H. B. Maynard
Published in 1956 by McGraw-Hill Book Co., 330 W. 42nd St., New York, N.Y. About 1500 pages. Price: $17.50.

This is a brand-new handbook (not a revision of an earlier edition) to which 81 leaders in the field — management consultants, professors, executives, practicing engineers — have contributed. It is divided into eight sections averaging nine chapters each. The first, "The Industrial Engineering Function," is a general survey of the development, scope, use, and organization of industrial engineering. The next six sections deal with the technical topics commonly thought of as parts of industrial engineering. Although many chapter headings at first glance resemble each other, a closer look at the chapters themselves reveals very little duplication. There seems to be general agreement on principles among the authors. The last section is a catch-all for those topics that broaden the engineer's usefulness: estimating procedures, safety, personnel testing, operations research, report writing, fundamentals of automation, etc. There is a 14-page index.

"Selling Color to People"

By Faber Birren
Published in 1956 by University Books, Inc. 404 Fourth Ave., New York, N.Y. 219 pages. Price: $7.50.

The purpose of this book is to answer commercial color problems encountered by business executives, sales managers, salesmen, stylists, designers, advertising men, and research specialists. The author, one of the nation's leading colorists, operates a color research agency serving the largest number of accounts of anyone in his field. As such, he can be expected to speak with top authority on principles of color research, market studies, consumer polls, retail sales tests, and color systems and tools.

Highlights of the book are a review of color in advertising brought up to date with new data drawn from new sources—newspapers, magazines, direct mail, and displays; and a thorough analysis of color television from a commercial standard.

Automatic molding presses. Line of completely automatic compression molding presses in 50, 75, 100, 150, 200, and 300-ton sizes is described in illustrated Bulletin A-456. 4 pages. *Hull-Standard Corp., Abington, Pa.*

Rubber. Neoprene Notebook No. 70, seventeenth in the "Language of Rubber," tells how the industry tests and evaluates the physical and chemical properties of elastomers and gives new applications. 7 pages. "Facts about Hypalon No. 4" describes the materials resistance to oxidizing chemicals and to non-oxidizing agents. *Elastomers Div., E. I. du Pont de Nemours & Co., Wilmington 98, Del.*

Injection molding machines. Booklet illustrates and discusses a number of different "Mini-Jector" injection molding machines for small jobs. Specifications, a price schedule, and a list-

ing of some of the companies and organizations using the machines are given. 30 pages. *Newbury Industries, Munn Rd., Newbury, Ohio.*

Injection molding machines, preplasticator units. Illustrated leaflets deal with the SH 1 injection molding machine, SH 4 fully automatic injection molding machines, the 1044 Autoplas single stage multi-screw preplasticator unit, and AP 2088 single stage multi-screw preplasticator unit. 4 pages each. *R. H. Windsor Ltd., Leatherhead Rd., Chessington, Surrey, England.*

Color slide film. A selling tool for builders, floor covering dealers, manufacturers, and others interested in plastic wall tile has been made available in the form of a color slide film called "Quality Plastic Wall Tile—Plus Value for Today's Home." Benefits of plastic wall tile and examples of installations are presented. *Plastic Wall Tile Div., The Society of the Plastics Industry, Inc., 250 Park Ave., New York, N. Y.*

Fat derivatives. Specifications and typical uses of Hydrofol fatty acids, glycerides, sperm oils, and fatty alcohols are shown in Technical Bulletin 908-A. 4 pages. *Chemical Products Div., Archer-Daniels-Midland Co., 2191 W. 110th St., Cleveland 2, Ohio.*

Copper clad. Illustrated technical data booklet advises on the proper selection of laminates, and tells how to make a printed circuit using both the photo engraving and silk screen methods. It also covers plated circuits, plating through holes, flush circuit production, and circuit fabricating. 15 pages. *Formica Corp., subsidiary of American Cynamid, 4614 Spring Grove Ave., Cincinnati 32, Ohio.*

Chemical plants. Brochure describes the basic design considerations involved in setting up plants for the manufacture of alkyd resins, fatty alcohols, phenolic resins, and maleic anhydride, and for fatty acid hydrogenation. Typical flow sheets, piping layouts, equipment designs, and installations are illustrated. 12 pages. *Process Plants Div., Industrial Process Engineers, 8 Lister Ave., Newark 5, N. J.*

Color chart. Specific gravity, bulk density fineness residue on 325-mesh screen, oil absorption, and composition are among the data and specifications given in a color chart devoted to inorganic color pigments. *Color Div., Ferro Corp., 4150 E. 56th St., Cleveland 5, Ohio.*

Corrugated boxes. "How to Specify Corrugated Boxes," provides a convenient check list on selecting the type of corrugated box best suited for specific packaging needs. 24 pages. *Hinde & Dauch, Sandusky, Ohio.*

Marking machines. Brochure illustrates equipment, from light-duty bench mounted units to heavy-duty, automatic machines for marking round, flat, and contour-surface products. Specifications and short descriptions of each machine are given. 4 pages. *Jas. H. Matthews & Co., Inc., 3942 Forbes St., Pittsburgh 13, Pa.*

Plastic tooling. Digest concisely summarizes existing applications of plastic tooling for thermoforming and metal-forming and in foundry practice. Capsule descriptions of the various epoxy and phenolic resins available for casting and laminating are included. 8 pages. *Marblette Corp., 37-31 30th St., Long Island City 1, N. Y.*

Epoxy resins. Chart gives physical and electrical data on 27 epoxy resin systems. Included are room temperature set, heat-cured, filled, unfilled, resilient, and rigid resins. *Furane Plastics, Inc., 4516 Brazil St., Los Angeles 39, Calif.*

Flexible polyethylene pipe. Bulletin CE-57 gives applications for polyethylene pipe, sizes and fittings, installation instructions, technical properties, and estimated flow rates for water in various pipe sizes. Industrial liquids, e.g. acids, organic chemicals, etc., which can be carried in polyethylene pipe are specified. 8 pages. *Supplex Co., Div. of American Hard Rubber Co., 93 Worth St., New York 13, N. Y.*

High styrene resin. Bulletin HY-2 gives specifications, chemical analysis, physical properties, applications, etc., of "Hystron," a high styrene resin. 11 pages. *Harwick Standard Chemical Co., 60 South Seiberling St., Akron 5, Ohio.*

Plasticizers. Booklet discusses plasticizers ranging from monomeric esters to complex, high molecular weight polymers. 4 pages. *The Resinous Products Div., Rohm & Haas Co., Washington Sq., Philadelphia 5, Pa.*

Custom injection molding. Two-color brochure explains ways in which the company is equipped to offer manufacturers plastic product design, development, and injection molding, decorating, and assembly facilities. 12 pages. *Morningstar Corp., Dept. JJ, 156 Sixth St., Cambridge 42, Mass.*

Injection molding. Bulletins 104 and 105 discuss, illustrate, and give specifications for two injection molding machines that have been redesigned for greater capacity, higher pressure, and faster operation. 4 pages each. *The Lewis Welding & Eng. Corp., Interstate St., Bedford, Ohio.*

Stainless steel clamps. Application chart shows the correct size clamp to be used with any given type and size of plastic pipe. *Ideal Corp., 435 Liberty Ave., Brooklyn 7, N. Y.*

Molded hard rubber. Brochure contains detailed application and characteristics charts and technical molding tolerances of hard rubbers, and provides a guide to the selection of compounds to meet general needs. 4 pages. *Stokes Molded Products, Div. of Electric Storage Battery Co., Taylor at Webster Sts., Trenton 4, N. J.*

Industrial instrumentation. Bulletin F-403 describes instrument systems that feature four basic components which can be interchanged to perform a vari-

ety of functions, as well as to minimize maintenance problems. 4 pages. *Fielden Instrument Div., Robertshaw-Fulton Controls Co., 2920 North 4th St., Philadelphia 33, Pa.*

Mold preparation. Leaflet explains the composition and uses of mold preparation materials and gives advice on proper storage. Methods of application by wiping, brushing, or spraying are also described. *Marblette Corp., 37-31 30th St., Long Island City 1, N. Y.*

Magnets. Catalog 156 gives a basic analysis of permanent magnetic properties and the importance of engineered applications. Magnets for installation on feed hopper of injection molding machines are among industrial applications described. 15 pages. *Magni-Power Co., Dept. 74, Wooster, Ohio.*

Precision tumbling. Revised brochure describes finishing of plastics, metal castings, other parts in company's multi-barrel slide-honing unit. 8 pages. *BMT Manufacturing Corp., 110 East 9th St., Elmira Heights, N. Y.*

Laboratory mills. Bulletin 203 describes a series of 6- by 13-in. laboratory mills for plastics and rubber. Text and illustrations contain all the information needed to choose from six standard models. 11 pages. *Farrel-Birmingham Co., Inc., Ansonia, Conn.*

Thermistors. Catalog EMC-1 gives dimensional drawings, physical descriptions, and complete electrical specifications for various forms of precision thermistors, including beads, rods, disks, washers, and built-up assemblies. Included are typical applications, illustrated with schematic circuits. 12 pages. *Fenwall Electronics, Inc., Framingham, Mass.*

Synthetic organic chemicals. Seventy-seven commercially available synthetic organic chemicals, with formulas, product descriptions, and suggested uses, are listed in Catalog S-101. In addition, there is detailed information on 22 semi-commercial and 17 experimental compounds. 12 pages. *Pennsalt Chemicals, Dept. S, 3 Penn Center Plaza, Philadelphia 2, Pa.*

Plastic sealer. Folder describes the Rayseal heat sealing generators in sizes from ½- to 5 kw. which are adaptable to either long straight-line work or intricate curved seals. *Raybond Electronics, Inc., 66 Needham St., Newton Highlands 61, Mass.*

Fatty acid. Booklet contains complete description, specifications, characteristics, and shipping data on Empol 1022 polymerized fatty acid. Included is an end-use bibliography. 20 pages. *Emery Industries, Inc., Dept. 5, Carew Tower, Cincinnati, Ohio.*

Monomers. Brochure F-40033 gives important physical properties and suggested uses for 36 monomers available from the company. 4 pages. *Carbide and Carbon Chemicals Co., 30 E. 42nd St., New York 17, N. Y.*

High polymers. A directory of materials lists high polymer rubbers, resins, latices, and related chemicals for the plastics, rubber, paint, textile, and paper industries. Color and form, package unit, descriptions, and applications of the different products are given. 5 pages. *The Goodyear Tire & Rubber Co., Inc., Akron 16, Ohio.*

Testing instruments. Brief descriptions and illustrations of 37 instruments for testing abrasion resistance, thickness, compression and recovery, and other physical data on plastics, textiles, paper, light metals, etc., are included in Catalog CS-56. 8 pages. *Custom Scientific Instruments, Inc., 541 Devon St., Kearny, N. J.*

Polystyrene production. Some of the problems encountered, and a summary of the requirements for the production of high quality commercial polystyrene are found in "'Secrets' of Commercial Polystyrene Production," published as TSB-8-56. Of particular interest is a discussion of problems arising from high proportion of styrene monomer and other volatiles which can, in effect, depreciate an otherwise seemingly high-quality polystyrene. 3 pages. *Chemical Div., Koppers Co., Inc., 1450 Koppers Bldg., Pittsburgh 19, Pa.*

2-Methyl-5-ethyl pyridine. Bulletin F-7621 gives information on properties, specifications, applications, and typical reactions of 2-methyl-5-ethyl pyridine, an intermediate for vinyl pyridines used in the manufacture of certain synthetic fibers and synthetic rubbers. It is a solvent and reaction medium used in the manufacture of dyestuffs. 6 pages. *Carbide and Carbon Chemicals Co., 30 E. 42nd St., New York 17, N. Y.*

Heat transfer systems. Bulletin RC-1 furnishes complete information on one, two, and three roll units incorporating the company's Spra-Blast for heat transfer; Types B and C Spra-Cool conveyors for applications where material is fed to cooler in sheet or extruded form; and Spra-Blast cooled tunnels used in installations where temperature control of process material is essential. 4 pages. *Mayer Refrigerating Engineers, Inc., Lincoln Park 3, N. J.*

Adhesive. Bulletin No. 03-9-4-9-56 lists the function, composition, properties, consistency, uses, and applications of Thixon NB, rubber-to-metal bonding adhesive. *Harwick Standard Chemical Co., 60 South Seiberling St., Akron 5, Ohio.*

Radiant heater. Bulletin CS-607 describes the Chromalox U-Rad radiant heater for vacuum forming, embossing, vinyl fusing, post-forming, and resin curing. 4 pages. *Edwin L. Wiegand Co., 7500 Thomas Blvd., Pittsburgh 8, Pa.*

Polyethylene. Marlex 50 polyethylene is discussed in an illustrated booklet that gives information on injection molding, pipe extrusion, film, blow molding, wire and cable coatings, filaments, corrosion resistant uses, vacuum forming, supported film, calendering, and rubber compounding. Also discussed are molecular structure, physical properties, stability, chemical resistance, re-

sistance to environmental stress, effect of radiation, color, and purity. 25 pages. *Plastics Sales Div., Phillips Chemical Co., 80 Broadway, New York 5, N. Y.*

Silicones. Folder 29 contains latest developments in silicones of interest to design engineers. Also listed are the company's latest publications on new developments and technical data. *Dow Corning Corp., Midland, Mich.*

Index. Bulletin G-2 is an index of literature covering catalogs, bulletins, specification and data sheets, illustrated lectures, and articles put out by the company's Instrumentation Division. 20 pages. *Minneapolis-Honeywell Regulator Co., Wayne and Windrim Avenues, Philadelphia 44, Pa.*

Neoprene. Water resistance is the theme of "Neoprene Notebook No. 71," part 18 in the "Language of Rubber" series. The brochure explains how the industry evaluates the water resistance of elastomers, and points out that actual experience has proved the serviceability of properly compounded neoprene compositions in aqueous environments. 7 pages. *Elastomers Div., E. I. du Pont de Nemours & Co., Wilmington, Del.*

Encyclopedia corrections

We have been informed by Merix Chemical Co., Chicago, Ill., that the name Stabilite, given as tradename of a destaticizer/U.V. absorber on p. 349 of the 1956 Modern Plastics Encyclopedia Issue, had been publicly withdrawn and should be replaced by "AST.CONC. #1001." As a destaticizer, it should only be used in certain water dilution ratios. Merix Chemical Co. also produces Anti-Static "#79-OL" for plastic films and fabrics and "New #79 Concentrate" for more permanent destaticizing of molded and extruded plastics.

It has also been called to our attention that the manufacturer of Stafoam and Polyrubber was incorrectly listed on p. 520 of the Foamed Plastics Chart. The producer of these polyurethane foams is American Latex Products Corp., Hawthorne, Calif.

mp Plastics

Production and sales figures in 1000 lb.* for July and August 1956

Materials	Total p'd'n first 8 mos. of 1956‡	Total sales first 8 mos. of 1956‡
Cellulose plastics:[a]		
Cellulose acetate and mixed ester		
Sheet, under 0.003 gage	12,892	13,057
Sheets, 0.003 gage and over	10,647	10,474
All other sheets, rods, tubes	5,005	4,871
Molding, extrusion materials	57,032	56,532
Nitrocellulose sheets, rods, tubes	3,873	3,442
Other cellulose plastics	3,785	3,387
Phenolic and other tar-acid resins:		
Molding materials[a]	150,036	131,156
Bonding and adhesive resins for:		
Laminating (except plywood)	41,714	28,773
Coated and bonded abrasives	10,108	10,469
Friction materials (brake linings, clutch facings, etc.)	**	**
Thermal insulation	37,517	36,739
Plywood	28,738	23,329
All other bonding uses	34,313	32,023
Protective-coating resins	19,642	17,428
Resins for all other uses	21,908	19,126
Urea and melamine resins:		
Textile-treating resins	28,900	26,552
Paper-treating resins	15,951	15,074
Bonding and adhesive resins for:		
Plywood	68,686	63,987
All other bonding and adhesive uses, including laminating	16,532	15,351
Protective-coating resins	23,756	17,516
Resins for all other uses, including molding	56,980	54,542
Styrene resins:		
Molding materials[a]	291,877	265,776
Protective-coating resins	62,324	61,280
Resins for all other uses	67,677	67,073
Vinyl resins, total[b]	486,234	463,584
Polyvinyl chloride and copolymer resins (50% or more polyvinyl chloride) for:		
Film (resin content)		49,492
Sheeting (resin content)		37,299
Molding and extrusion (resin content)		129,965
Textile and paper treating and coating (resin content)[c]		40,025
Flooring (resin content)		41,005
Protective coatings (resin content)		18,614
All other uses (resin content)		46,739
All other vinyl resins for:		
Adhesives (resin content)		24,897
All other uses (resin content)		75,548
Coumarone-indene and petroleum polymer resin:	164,706	161,309
Polyester resins:	48,493	42,745
Polyethylene resins:	355,341	329,247
Miscellaneous:		
Molding materials[a, d]	28,119	24,848
Protective-coating resins[e]	6,902	3,487
Resins for all other uses[f]	79,191	72,261

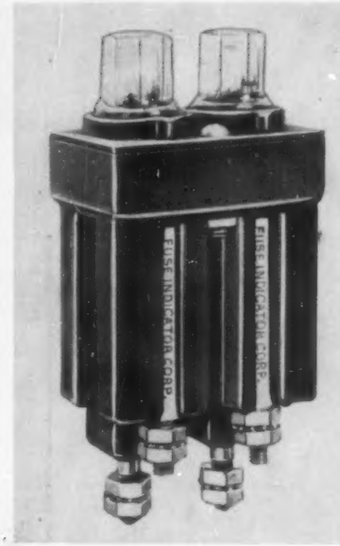
*Dry basis designated unless otherwise specificed. †Revised. ‡Partially estimated. **Included with "All other bonding uses." [a]Includes fillers, plasticizers, and extenders. [b]Production statistics by uses are not representative, as end use may not be known at the time of manufacture. Therefore, only statistics on total production

Production

From statistics compiled by the U. S. Tariff Commission

July†		August‡	
Production	Sales	Production	Sales
1,112	1,331	1,787	1,601
817	1,178	1,514	1,486
426	510	515	537
5,872	5,769	7,395	7,698
344	323	443	376
370	262	554	459
13,455	13,020	16,114	13,730
3,929	2,619	4,783	3,640
1,031	1,241	841	753
**	**	**	**
4,436	4,776	4,402	4,029
2,640	2,057	3,747	3,143
3,414	3,475	4,301	3,660
1,793	1,882	2,361	1,695
2,302	2,105	3,639	3,142
2,386	2,977	2,654	2,711
1,411	1,451	1,748	1,666
6,633	6,632	8,004	8,086
1,314	1,476	1,715	2,144
2,196	2,020	2,817	2,366
4,157	5,993	7,051	7,352
34,154	27,254	34,519	31,073
5,978	6,463	6,401	7,154
7,123	7,118	9,769	9,701
49,751	48,480	57,051	63,412
	4,722		6,497
	3,714		4,787
	15,203		17,490
	4,298		5,727
	4,231		6,798
	2,681		2,416
	2,321		7,228
	3,165		3,256
	8,146		9,213
19,241	19,066	22,755	22,467
5,641	5,464	6,634	5,355
45,998	39,138‡	49,790	44,754
2,841	2,586	3,259	3,381
844	439	1,033	481
8,899	7,973	9,881	9,383

are given. [c]Includes data for spreader and calendering-type resins. [d]Includes data for acrylic, nylon, and other molding materials. [e]Includes data for epichlorohydrin, acrylic, silicone, and other protective-coating resins. [f]Includes data for acrylic, rosin modifications, nylon, silicone, and other plastics and resins for miscellaneous uses.



Signal lights are part of fuse holder molded of reinforced alkyd

Fuse holder

A new line of fibrous glass-reinforced alkyd fuse holders being produced by Fuse Indicator Corp., Boston, Mass., is especially designed for use in instrument, power, and telephone panels or wherever it is necessary or desirable to detect and identify a blown fuse quickly.

The fuse holders consist essentially of two fibrous glass-reinforced alkyd parts—a mounting base which attaches to the rear of the panel and one or more fuse carriers with built-in indicator lamps. Use of molded reinforced alkyd results in parts with high shock resistance, excellent dielectric properties, and high resistance to heat, moisture, and arc tracking—properties which are essential to the proper functioning of the holder.

When a signal light indicates a blown fuse, the carrier is removed from the base with a push-twist motion, a new fuse is inserted, and the fuse and carrier are returned to the base.

Credits: Reinforced plastics fuse carrier and base molded by Engineered Plastics, Inc., Watertown, Conn.; Plaskon alkyd and glass-reinforced alkyd molding compound supplied by Barrett Division, Allied Chemical & Dye Corp.

Garment bagger uses polyethylene film

Re-usable polyethylene film garment bags have now become economically feasible for use by quality dry cleaning establishments, thanks to the development of a new type of automatic bagging machine.

The machine, which is designed to make bags to size directly over the garment, is relatively simple to operate. The tubular film from which the bags are made is fed from a continuous roll at the back of the machine through a series of rollers at the back and top of the machine. The operator simply places the garment to be packed on a retractable bagger pole at the front of the machine and draws the film being fed through the rollers down over the garment to a point about 5 in. from the bottom hem. The operator then uses both hands to press a set of buttons on the sides of the machine which brings down a heat sealer on the film about 5 in. above the garment. A series of serrated blades cuts the film so that, when the sealer retracts, the bag, thus fabricated to the exact size desired, settles down over the garment. Pressing a foot-pedal lowers the pneumatic bagger pole so that the wrapped garment can easily be removed.

The machine, which sells for $995, operates on 110 v. and requires a compressed air line. Where such a line is not available, a compressor can be supplied. The machine is capable of bagging about 800 to 1200 garments of varying sizes in a single day.

From the standpoint of consumer satisfaction, garments packaged in polyethylene film bags have exceptional appeal. The tough, translucent film allows the customer to see his cleaned clothes without having to destroy the bag. And even after the customer takes his cleaned garments home, the bag can remain in place as a dust cover or storage bag that will resist moisture, rain, snow, oil, and grease.

Polyethylene bags made on the automatic machine are in the same price range with better quality paper bags. Because the polyethylene bags can be made to exact size, savings are provided by eliminating the material wasted when packaging an odd-sized garment in a standard-sized bag. It is estimated that the machine should pay for itself in a year's time in a dry cleaning establishment which uses 50,000 bags or more per year.

Use of the automatic machine also means that dry cleaners can save storage space and eliminate inventory control problems.

Credits: Machine developed by Mehl Mfg. Co., Div. Sydney-Thomas Corp., Cincinnati, Ohio; polyethylene film supplied by Bakelite Co.

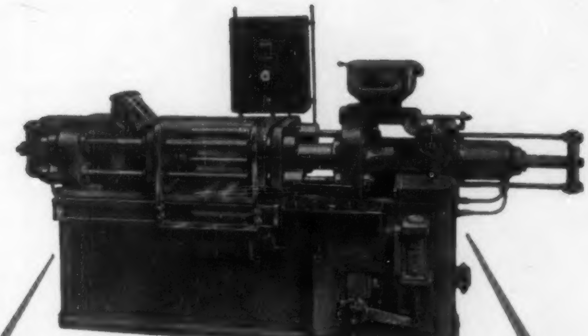
Back of garment bagger machine, showing roll of tubular polyethylene film

Operator draws tubular film over garment; it will later be sealed and cut off automatically

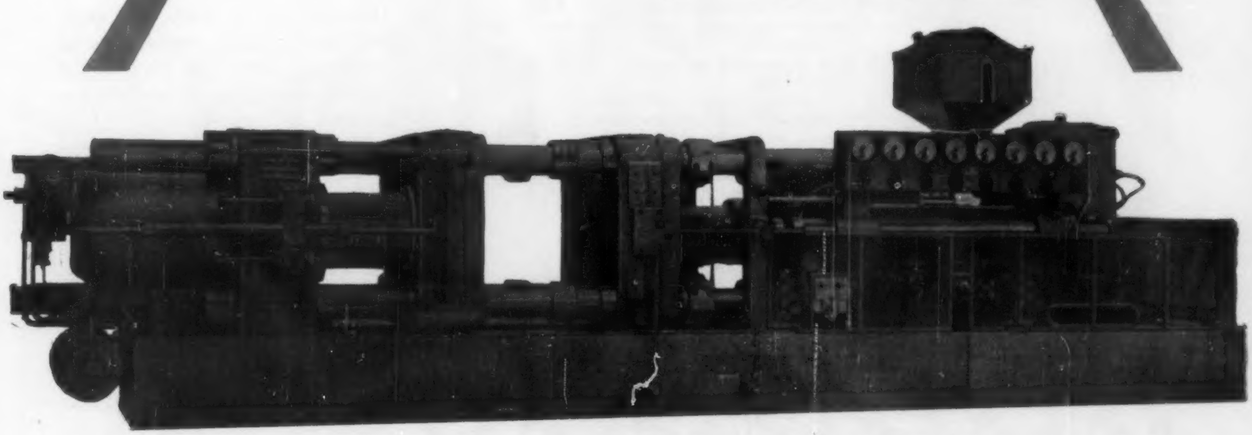
FIMSAI

INJECTION MOULDING MACHINES

MILANO ITALY



Capacity of our range
from 2 ounces
to 215 ounces



Illustrated Literature sent post free

EXPORT DEPARTMENT

SCACCHI & C^IE — 45 RUE D'ARTOIS, PARIS VIII^e —

CABLE ADDRESS
SCACCHI—Paris

Mass production for reinforced plastics

Development of a low-cost process which introduces high-speed mass-production techniques to the manufacture of fibrous glass-reinforced plastic products has been announced by Pressurform Co., Swarthmore, Pa. The new process, fully automatic and continuous, makes possible for the first time the precision mass production of products of non-uniform thickness. Key to the process is rapid production of "preforms" which are the shape of the finished product but which consist only of reinforcing material. They are produced in 30 sec. to 2½ min., depending on design. Ribs, bosses, and other protuberances become integral parts of the preform in one operation. The reinforcement consists of varying proportions of fibrous glass and any one of several organic materials. The preform, along with a resin, is placed in a mold under pressure to produce the finished product.

The precision with which the preform is made permits use of the entire preform in the mold, eliminating the waste of "pinch offs." The process also achieves a product of uniform density by maintaining a constant ratio between the glass reinforcement and the resin regardless of varying thickness. And it permits the use of different proportions of glass to other reinforcements to meet different strength and cost requirements.

Principal significance of the process, it is believed, is that it will lead to wider applications of reinforced plastics because of the greater flexibility of product design which it permits.

Pressurform Co. was organized to license the process and will not engage in commercial manufacturing operations itself. Already licensed to use the process is Banner Fiberglass Products Corp., Paterson, N. J., which will manufacture re-usable airborne radar shipping and storage containers and other items. Also licensed is Pressurform Container Corp. which will manufacture for developmental and demonstration purposes.

Phenolic disk for shower head

A small, but functionally important, molded phenolic disk is the key element in the design of a new type of self-cleaning shower head.

The spring-loaded disk is located in the center of the shower head. When the water is turned on, pressure forces the disk down into "spray" position. Water simultaneously passes out through the center and through the serrated edges of the disk in an evenly distributed spray that cannot spread outward to walls or shower curtains.

When the water is turned off, the spring pulls the disk back up into "drain" position. The inside of the shower head drains instantly, discharging any waterborne substances and cleaning itself automatically.

The phenolic disk is transfer molded in a four-cavity mold, at the rate of 43 shots per hour. Because it is molded in one piece, complete with serrated edges and molded-in center opening, the plastic disk is much easier and less costly to produce than a machined brass unit.

Phenolic's dimensional stability and heat and water resistance also figured prominently in the selection of the material, since any expansion of the disk would interfere with its free movement within the head. In addition, phenolic inhibits the formation of clogging lime deposits.

Credits: Disk is molded for Sloan Valve Co., Chicago, Ill., by Chicago Molded Products Corp., Chicago, Ill. Phenolic BM-7156 by Bakelite.

Molded disk (lower left) controls water flow and drainage in shower head

Polyethylene pipe for pest control

Efficient fumigation of large-area storage spaces and of grain in bulk quantities is made possible at lower cost with a recently developed polyethylene piping system.

As introduced by Larvacide Products, Inc., New York, N. Y., (whose main business is chemical fumigants), the system, consisting of small-diameter, flexible pipe plus necessary fittings, and supplied to the user for installation, carries fumigant in liquid or aerosol form from storage container to point of fumigation.

Heretofore, space and bulk grain pest control was a cumbersome and expensive proposition. If a permanent piping system was to be installed it had to be of brass (at 25¢/linear ft.) because the chloropicrin pesticide has a tendency to be corrosive. If no pipe system was employed, fumigant had to be applied manually, preferably by skilled personnel. This involved considerable labor cost, constituted a health hazard, and did not provide a high degree dosage precision.

With polyethylene pipe, costing on an average only between 3 to 5¢/ft., and unaffected by the fumigant, these drawbacks are overcome.

Two sizes of pipe are used: for space (aerosol) fumigation, 3/8-in. O.D., 1/4-in. I.D., 100 p.s.i. working pressure stock; for grain (liquid) fumigation 1/2-in. O.D., 145 p.s.i. pipe. Discharge of fumigant is through copper jets inserted between lengths of tubing by means of brass tees. Brass fittings are used also to connect lengths of pipe.

The market for this pipe is as follows: an average of 1000 ft. each for 1500 flour, seed, and rice mills; 500 wholesale seed houses; 100 macaroni plants, 100 candy plants; and 100 tobacco warehouses. In addition there is a total of 25,000 country elevators, each of which can use an average of 3000 ft. of pipe.

Credits: Pipe extruded of natural polyethylene by Carlon Products Corp., Cleveland 5, Ohio, and Gering Products, Inc., Kenilworth, N. J.

Packaging plastics

(From pp. 115-122)

electric clocks, several of which embody molded plastic cases of intricate design. Typical of these units is the Fireplace clock, whose molded Tenite case is designed to resemble a miniature mantel, complete with fireplace, andirons, and logs. This clock is packaged in a corrugated container (Fig. 8, p. 117) with die-cut inserts which fit snugly around the clock and cushion it against shock during shipment and handling.

Molded plastic cabinets for record players and small radios are sometimes shipped to the assembly plant by the molder in the same container which is ultimately used to carry the finished set to distributors. A typical cabinet now being molded of styrene copolymer by the Plastics Div., General American Transportation Corp., Chicago, for a major electronics manufacturer is first wrapped in two die-cut pads of corrugated paper having a layer of cellulose padding to prevent abrasion, then placed in a corrugated shipping container fitted with pads at each end and a corrugated sleeve which is laid on the top of the cabinet to prevent it from shifting within the package. Following assembly of the finished radio by the manufacturer, the unit is reshipped in the same package (Fig. 9, p. 117) for final sale.

A somewhat different packaging approach involves radio cabinets produced for Zenith Radio Corp. by Plastic Molded Products Co., Chicago. The case in point, typical of the packaging procedure followed for several molded plastic radio cabinets made for Zenith, is the new Pacemaker AC-DC table model, molded of high impact styrene in a choice of three colors. After molding and degating these cabinets, the molder places each in a separate polyethylene bag. Bagged cabinets are then stood on end in corrugated shipping containers having interlocking vertical partitions which divide them into 18 independent cells. At the Zenith plant, where the radios are assembled, the cabinets are removed from the containers and inspected. The shipping boxes and partitions are then knocked down flat and shipped back to the molder for re-use. The polyethylene bags, retained by Zenith, are used to encase the completed radio sets in a protective covering which shields them against soiling or scuffing until the set is in the hands of the ultimate purchaser.

One of the largest plastic parts now being made for the electronics field is a tube mask and screen escutcheon for color television sets. This part, produced by the GATX Plastics Div., is injection molded of styrene alloy and weighs approximately 7 pounds. After molding, it is painted on the escutcheon area only; other areas of the piece are concealed in the finished assembly. Although this part is not easily damaged, the painted area must be protected against scratching. In delivering these

components to the manufacturer, GATX uses a double-wall corrugated container measuring 52 by 40 by 22 in. deep. Consisting of a base, cover, and tube which forms the sidewalls, the container is one in which molding material is delivered to GATX. By inserting vertical partitions to prevent contact between the plastic parts and two filler pads at one end to eliminate void space, the molder is able to ship 16 of the heavy TV components with adequate protection. (Fig. 10, p. 118.)

Containers and closures

The rapid growth of molded plastic re-use containers, refrigerator storage boxes, polyethylene squeeze bottles, and other containers finds many molders producing and shipping products of this type. Many firms are also producing plastic caps and closures which must be delivered to the point of use.

Premium Plastics Co., Chicago, a major supplier of re-usable molded plastic containers for ice cream, prepared salads, and other food products, relies heavily on proper packaging to carry these containers to its customers in clean, undamaged condition. Premium uses both regular and high-impact styrene for the container bodies; the flexible sealing type covers are molded of polyethylene.

A typical shipping container used by Premium Plastics for pint size transparent styrene packages (Fig. 11, p. 118), consists of a corrugated shipping container with slotted pre-assembled partitions and a corrugated divider separating the pack into two tiers. The carton contains ten nested styrene containers in each cell, providing 250 units per layer and a total of 500 units in the package. Packing is done directly at the molding machine by the press operator.

It is interesting to note that similar containers molded of impact styrene are nested and laid horizontally rather than vertically in the shipping boxes. Early experience with a vertical nesting arrangement showed that, be-

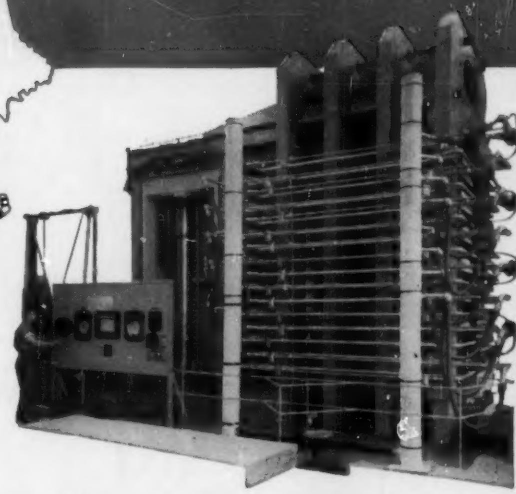
(*To page 232*)

DEVELOPS–DESIGNS–BUILDS

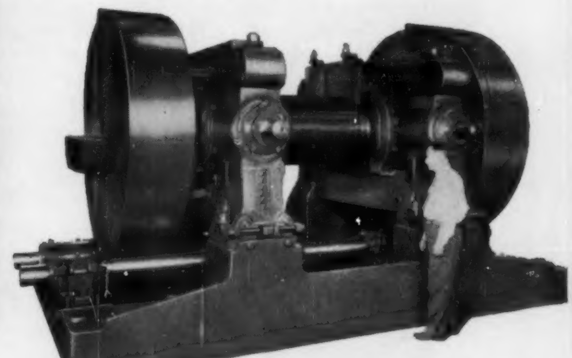
basic and special machinery

for **rubber • plastics • plywood • hardboard • chemicals • pharmaceuticals**

heavy testing equipment for the steel, automotive, and aircraft industries



54" x 124" Hydraulic Press
Platen Pressure—1500 psi



28" x 42" Double Geared
Cracker for Giant Tires

WHERE is ADAMSON equipment found?

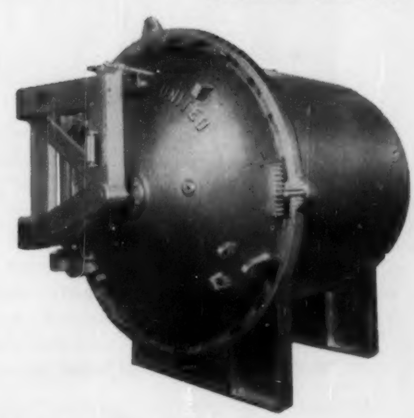
IN 40 OF THE 48 STATES. Each dot on the United States map represents a city in which ADAMSON equipment has been installed. ADAMSON equipment also sold to 32 foreign countries, as listed on the left.

WHO buys it?

77 percent of ADAMSON business is with the top 500 United States corporations listed in a recent issue of FORTUNE magazine.

Perhaps the best proof of the flexibility and scope of our manufacturing and engineering skill lies in the answer to those two questions—*WHERE* and *WHO?*

Our job is to serve big and little businesses alike. We welcome an opportunity to discuss your problems with you, either in your office or in ours.



72" I.D. Hinge Type Autoclave

Branch Offices in NEW YORK • CHICAGO • GREENSBORO, NORTH CAROLINA • *and* TORONTO, CANADA.
European Sales handled through GILLESPIE & COMPANY OF NEW YORK *with representatives in most European countries.*

cause of their greater flexibility, the impact type containers tended to telescope too tightly and were hard to separate. With horizontal packing, vertical dividers are eliminated and it is possible to use a somewhat smaller container for the same number of units, with resultant saving in packaging cost.

The polyethylene lids are packed in corrugated shippers holding 1000 units. Within the cartons (Fig. 12, p. 119), lids are arranged in layers of 25, with paper separators. This packing method keeps the lids clean and also prevents warpage, since they are still hot when the press operator degates them and places them in the package.

Formold Plastics, Inc., Blue Island, Ill., uses two principal types of packages in shipping thermosetting and thermoplastic closures and caps to its customers. In both instances, inner polyethylene bags have eliminated shipping problems. Outer containers include the fibre shipping drums in which molding materials are received as well as corrugated boxes in several sizes. Previously, paper bags were used as inner packages in both types of containers. Replacement of these bags with polyethylene bags has eliminated the problem of breakage encountered with the paper liners. Although the plastic bags range in cost from 15 to 25¢, depending upon size, Formold has found them a worthwhile investment, considering that the total value of plastic parts in a shipping container may run from \$25 to \$75. The company also gives its customers credit on return of the plastic bags and is able to re-use many of them.

Corrugated container sizes frequently used by Formold are 12 by 12 by 12 in. and 15 by 15 by 15 in.; these packages are easily handled by female employes and keep the total weight in the 20- to 35-lb. range. If the customer desires to stack the containers to conserve warehouse space, Formold inserts diagonal vertical partitions in the packages. After parts have been loaded into a package (Fig. 13, p. 119) the plastic bag is twisted and closed at the top, using a hand tool which applies a wire tie.

Signs and lighting components

Plastic signs and lighting components present shipping problems because they are often large in size and have painted areas or other design features which must be adequately protected against scuffing or breakage.

Wakefield Co., Vermilion, Ohio, found it rewarding to adopt a specially designed triangular corrugated container (Fig. 14, p. 118) for shipping its new Beta-style lighting fixtures, which combine metal and translucent plastic components. The new contour-fitting container wraps around the fixture to form a hexagonal pyramid stitched at the top and end panels. This construction enables Wakefield to stack alternate layers inversely, saving space. Adoption of the new container, according to Wake-

field, has brought a 30% saving in storage and shipping space. In addition, there is a 22% saving in package cost.

Neon Products, Inc., Lima, Ohio, large producer of both exterior and interior illuminated acrylic signs, subjects every package to rigid tests under actual in-transit conditions before adopting it. For interior signs, Neon Products designs special corrugated shipping containers (Fig. 15, p. 118) with die-cut pads and inserts to cushion the units against damage. Large exterior signs are shipped (Fig. 16, p. 119) in wirebound crates fitted with suitable interior bracing.

Furniture components

As molders expand their activities in the production of furniture components, packaging becomes a major consideration since parts must often be shipped a considerable distance to the furniture manufacturing plant. This problem is illustrated by the experience of General Electric Co.'s Plastics Dept. in producing injection molded thermoplastic drawers for a new line of bedroom furniture sold by Sears, Roebuck.

In developing these drawers, the packaging problem was considered even during the design stage. The drawers' backs and fronts have an almost indiscernible taper which permits them to be nested for compact shipment. Because of the design of the drawers, including the open front section to which any desired type of wooden front can be attached, GE is able to pack 26 of the larger drawers in a heavy-duty corrugated container (Fig. 17, p. 119) measuring approximately 36 in. square and equally deep. Two corrugated rectangles beneath each drawer prevent it from settling into the drawer beneath it and scratching the interior.

The GATX Plastics Div., in shipping molded reinforced plastic chairs complete with wrought iron legs, uses a large corrugated container which holds two of the chairs. The legs and hardware, wrapped in kraft paper, are placed in the bottom of the box and a corrugated insert, folded in the shape of an inverted "U"

(Fig. 18, p. 120) forms a supporting platform for the nested chair shells. A sheet of florist's wax tissue placed between the two molded shells prevents chafing. When the top flaps of the container are closed and taped, the chairs are held securely against the corrugated pad.

Automotive parts

The shipment of automotive dial faces, speedometer crystals, and similar parts to the manufacturer often poses a problem for custom molders. One company which has found an excellent solution is G. Felsenthal & Sons, Inc., Chicago, which uses corrugated paper to handle the packing and shipping of acrylic automotive clock dials. (See Fig. 19, p. 120). Damage is almost negligible and inspection time has been cut nearly in half by simply "filing" the parts into slots formed by a corrugated liner in the cartons.

The new packing method, developed with the cooperation of Packing Materials Corp., Chicago, eliminates the previous system of tissue wrapping dials individually. Inasmuch as the dials are kept separated by the corrugations, scratching and marring cannot occur. Not only is time saved for the molder, but also on the customer's assembly lines: workers simply remove the parts from the carton for further assembly without loss of time for unwrapping. Felsenthal now uses this type of pack wherever applicable for shipping plastic parts.

Stimsonite Div., Elastic Stop Nut Corp., Chicago, also uses corrugated shipping boxes with cell-type partitions in shipping many of the automotive tail lamps and other acrylic parts made by this company. Whether individual parts are tissue wrapped depends upon the shape and size of the part. In some instances, it is possible to wrap only alternate parts without sacrificing protection. Molding cycles, the number of cavities in the die, and other production factors are studied in deciding how to pack parts.

A special pack for shipping Ford truck reflex tail lamp lenses illustrates how packages may be tailored to a specific plastic part. This package consists of an outer corrugated container and slotted corrugated sleeves. Each sleeve (Fig. 20, p. 120) holds five pairs of lenses, placed back to back; 12 such sleeves fit snugly into the container making a total of 120 units in the package. The die-cut slots which grip each pair of lenses are spaced so that adjacent sleeves may be alternated end for end, permitting the protruding portion of the lenses to interleave without touching (Fig. 21, p. 120).

Major appliance components

Producers of refrigerator and freezer components, washing machine agitators, and other major appliance parts are keenly aware that efficient packaging can spell the difference between profit and loss. As parts grow more complex, packaging problems are multiplied: Today's injection

molded or thermoformed refrigerator door liners cannot simply be packed on top of one another with a sheet of tissue between, as was the case with earlier, essentially flat liners. Such factors as the draft of parts, difference in draft between top and bottom edges, etc., must be weighed in deciding how the parts are to be packaged. Sometimes a semi-nesting technique can be used which will provide adequate protection and still conserve valuable shipping space. In certain instances, a moderate amount of abrasion may be tolerated on nested parts, provided that the area involved is not visible in the finished assembly.

Washing machine agitators, molded of phenolic material, are produced in large quantities by GATX. For units of this type, the molder uses a returnable corrugated shipping container with die-cut inserts which produce a three-tier pack. (Figs. 22, 23, and 24, p. 121.)

Refrigerator trim frames or "picture frames" present a problem in packaging because they are large, relatively fragile, and involve an open area in the center. To avoid shipping an excessive amount of dead space with these components, GATX developed a three-part pack consisting of a large corrugated exterior container, measuring 54 by 33 by 54 in. high, and two inner containers. Both of the latter stand upright within the outer box and are encircled by the injection molded styrene trim frames. The larger of these two boxes contains additional frames, standing vertically and separated by sheets of dry wax kraft paper; the other is an empty "dunnage" carton. (See Fig. 25, p. 122.) The success of this pack depends largely upon the use of protective corrugated paper sleeves or "U-clips" which prevent direct contact between the frames packed horizontally.

GATX was able to increase the number of injection molded styrene freezer and refrigerator door units per package from 13 to 22 by switching from a face-to-face and back-to-back packing arrangement to alternate partial nesting in groups of two units, as shown in Figs. 26 and 27, p. 122. In the new and more compact arrangement, the molder uses folded sheets of dry waved kraft paper between the parts to prevent abrasion.

The examples presented above show how enterprise and imagination can develop efficient packages for plastic products and components. By carefully studying the particular requirements of each plastic item to be shipped, the molder or fabricator will be able to come up with a package which will accomplish the job at minimum cost. In this effort, it will be found that the suppliers of shipping containers and other types of packaging materials are eager and willing to help. Playing for today's high stakes—and with improper packaging a tremendously heavy drain on profits—plastics manufacturers can scarcely afford to slight this highly important phase of their operations.—END

HARFLEX® 300

PERMITS A FREE FLOWING DRY BLEND

In a typical test, 64 parts of HARFLEX® 300, preheated to 212°F, were mixed with 100 parts of an easy-processing polyvinyl chloride resin at 212°F. After 30 minutes of thorough agitation, a dry, free flowing powder was obtained which could be put directly into an extruder. When a free flowing dry blend is used directly, as in extrusion operations, it is possible to eliminate or minimize extra operations such as Banbury mixing or roll milling.

HARFLEX® 300 is a permanent polymeric plasticizer, readily adaptable to dry blending. Write for our free technical bulletin that gives full information about HARFLEX® 300. Samples for your test or experimental work are also available at your request.

SEBACATES
PHTHALATES
ADIPATES

THE KEY TO HARCHEM® BETTER PLASTICS

HARCHEM DIVISION

WALLACE & TIERNAN, INC.
25 MAIN STREET, BELLEVILLE 9, NEW JERSEY
IN CANADA: W. C. HARDESTY CO. OF CANADA, LTD., TORONTO

H-21

1. SELECT the items you want
2. CIRCLE the corresponding numbers on the post card
3. FILL IN the information requested
4. MAIL — no postage required

HELPFUL LITERATURE FREE

There is valuable data — worth dollars and cents to you — in the literature and samples described below.

EQUIPMENT • SUPPLIES • SERVICES

MOLD TEMPERATURE CONTROL. 8-page booklet discusses temperature control in injection molding. Includes comparison chart of mold temperature requirements of 10 molding materials. Also describes company's water circulating mold heating and cooling unit. Sarco Company, Inc. (L-601)

ADHESIVES FOR POLYESTER FILM. Technical bulletin describes adhesives for use with "Mylar" polyester film. Discusses polyester, synthetic rubber and vinyl adhesives. Includes properties charts, information on proper use. E. I. du Pont de Nemours & Co. (L-602)

PROTECTIVE POLYETHYLENE FILM. Folder describes use of company's polyethylene film as a moisture-vapor barrier material. Describes characteristics of film and illustrates proper use, suggests applications. Gering Products, Inc. (L-603)

CUTTING EQUIPMENT FOR PLASTICS SHEET. 8-page booklet describes line of equipment for die-cutting plastics sheeting and for deflashing. Includes models for cutting materials up to 42 in. width and for heavy duty cutting. Also describes accessory equipment. United Shoe Machinery Corporation. (L-604)

MULTI-COLOR SPRAY ENAMELS. Technical bulletin describes enamels suitable for coating plastics with two or more colors at one time by standard spray techniques. Gives data on application, mixing, and storage. Atlas Synthetics Corporation. (L-605)

INJECTION MOLDING OF "CYCOLAC". Technical bulletin gives detailed molding instructions for "Cycolac" resin, a high impact thermoplastic multi-polymer. Includes general characteristics, properties. Marbon Chemical Division of Borg-Warner. (L-606)

RESINS FOR ELECTRICAL APPLICATIONS. Data sheets describe polyester resins for casting, potting, impregnating and dip-coating various types of electrical units. Includes properties, distinguishing characteristics, curing data. H. H. Robertson Company. (L-607)

AUTOCLAVES AND VULCANIZERS. Catalog illustrates and describes line of autoclaves and vulcanizers that can be used for low pressure thermoset molding of large objects. Adamson United Company. (L-608)

CIRCULATING OIL HEATER. Technical bulletin describes and diagrams high-temperature unit that heats and pumps oil for use as temperature control, such as in compression molding. Sterling, Inc. (L-609)

EXTRUDER MANUAL. 46-page technical manual describes design and performance features of company's extruders emphasizing construction of cylinders, screws, cooling systems, and motor drives. Prodex Corporation. (L-610)

HYDRAULIC EQUIPMENT CATALOG. 12-page catalog illustrates and describes line of compression and transfer molding presses with 100 to 500 ton capacities, 30 to 50 ton presses, small production and lab presses, hobbing and high pressure pumps. Elmes Engineering Division of American Steel Foundries. (L-611)

INJECTION MOLDING. Folder describes company's facilities for injection molding thermoplastics, including lists of presses, finishing and tooling equipment, materials handling equipment. Includes blueprint of floor plan. Minnesota Plastics Corporation. (L-612)

FOLDER-CREASER FOR RIGID SHEET. Illustrated folder describes machine that folds and creases cast and extruded thermoplastic sheet from .005 in. to .020 in. thicknesses. Suitable for making right angle folds for boxes, flat folds for turning edges. Taber Instrument Company. (L-613)

PULVERIZING EQUIPMENT. Illustrated folder describes line of equipment for blending and grinding particles. Also describes and illustrates equipment for clearing away dust and powder. Metals Disintegrating Company, Inc. (L-614)

CENTRIFUGAL MIXERS. Illustrated folder describes line of standard and corrosion-resistant high speed blending and mixing machines. Models available with capacities of 2,500 to 16,000 lbs. of finished mix per hour. Entoleter Division—Safety Industries, Inc. (L-615)

BRONZE PIGMENTS. Data sheets describe gold-bronze pigments, manufactured from alloys of copper and zinc for finishing transparent plastics or for use as a spray for decorating. Describe properties. Tools Disintegrating Co. (L-616)

VINYL CHLORIDE PLASTISOLS. Data folder describes hot and cold dip, spray, and foam plastisols. Includes general characteristics, properties and applications. Bradley & Vrooman Company. (L-617)

PLASTICS CONTROL EQUIPMENT. Illustrated data sheets describe working principles of an instrument that measures and records the plasticity of materials in graph form, and an instrument that measures and records viscosity of materials at different temperature levels. Brabender Corporation. (L-618)

PLASTICS COOLING EQUIPMENT. Folder describes single, double, and triple roll units for continuous sheet cooling; conveyors for cooling calendered or extruded materials; and cooling tunnels for use as a temperature control on the production line. Mayer Refrigerating Engineers, Inc. (L-619)

PLASTISOL APPLICATIONS. Data sheets describe properties for line of vinyl plastisols. Illustrates use as a coating for fabrics, wire goods and related materials; for decorative and protective coatings; and in sponge form for use as an insulating material. Stanley Chemical Company. (L-620)

STOCK KNOB CATALOG. 16-page catalog describes line of stock thermoset plastic knobs. Line includes utility, pointer, bar, instrument, lever, and dual control lever knobs. Contains specifications and side-view diagrams for each knob classification. Kurz-Kasch, Inc. (L-621)

HYDRAULIC PRESSES. Catalog gives capacities, sizes of platens, and speed for line of hydraulic molding, laminating, polishing, curing and embossing presses. Combination presses are also described. R. D. Wood Company. (L-622)

RESINS FOR REINFORCED PLASTICS. 58-page technical booklet discusses application, proper molding techniques and curing properties for line of polyester resins for reinforced plastics. Archer-Daniels-Midland Company. (L-623)

Fill out and mail this card now

MODERN PLASTICS

MANUFACTURERS' LITERATURE SERVICE

Please send me the free items circled below. I am ☐ a non-subscriber*

I am ☐ a subscriber

L-601	L-602	L-603	L-604	L-605	L-606	L-607	L-608	L-609	L-610	L-611
L-612	L-613	L-614	L-615	L-616	L-617	L-618	L-619	L-620	L-621	L-622
L-623	L-624	L-625	L-626	L-627	L-628	L-629	L-630	L-631	L-632	L-633
L-634	L-635	L-636	L-637	L-638	L-639	L-640	L-641	L-642	L-643	L-644

*If you do not have a personal subscription and would like to receive the next twelve monthly issues plus the next annual Encyclopedia issue (U.S.A. & Canada, $7.00; Pan America $10.00; all others, $20.00) please check below.

☐ Check enclosed ☐ Send bill

NAME .... **POSITION** ....

(Please Print Plainly)

COMPANY ....

STREET .... **CITY** .... **STATE** ....

(This card cannot be honored after March 1, 1957)

FREE HELPFUL LITERATURE

There is valuable data—worth dollars and cents to you—in the literature and samples described below.

1. SELECT the items you want
2. CIRCLE the corresponding numbers on the post card
3. FILL IN the information requested
4. MAIL—no postage required

EQUIPMENT · SUPPLIES · SERVICES

"TULOX" TUBING. Folder describes semi-rigid cellulose acetate, cellulose acetate butyrate thermoplastic tubing available in a variety of stock sizes in clear-transparent and colors. Includes discussion of advantages, limitations, and physical properties. Extruded Plastics, Inc. (L-624)

USES OF EXPANDED POLYSTYRENE. Illustrated booklet describes expanded rigid polystyrene, suitable as an insulating material at temperatures below 175 degrees F; as a buoyancy material, and a packaging substance. Includes discussion of properties. The Dow Chemical Company. (L-625)

POLYSTYRENE SHEET. Folder describes applications for toughened sheeting for pressure molding, vacuum forming or embossing. Available in rolls, sheets, panels in several colors. B. X. Plastics, Ltd. (L-626)

DERMATITIS PREVENTION. Folder describes skin cream said to provide a barrier for protection against epoxy and formaldehyde resins and resin solvents. Includes results of tests for effectiveness. Milburn & Company (L-627)

SYNTHETIC WAXES. 16-page booklet describes line of synthetic waxes used with plastics as an anti-static and anti-tack agent, as a polish and as a mold release. Lists properties and quantities available. Glyco Products. (L-628)

HOPPER-DRYER. Folder describes hopper designed as accessory equipment for injection molding or extrusion machines. Unit provides continuous drying and preheating of material. Includes specifications. Thoreson-McCosh, Inc. (L-629)

HYDRAULIC MOLDING PRESSES. Folder describes company's hydraulic drive units, compression and transfer molding presses. Includes description of horizontal hydraulic pelleters, alkyd molding press. Specification charts included. B. I. P. Engineering, Ltd. (L-630)

FLEXIBLE PLASTICS PIPE. Folder illustrates applications of flexible polyethylene plastics pipe. Discusses proper installation, illustrates pipe fittings. Crescent Plastics, Inc. (L-631)

PLASTICIZER PERFORMANCE. 32-page booklet contains performance charts, data on properties, methods of testing for line of polymeric and monomeric plasticizers. Suggests suitable stabilizers. Emery Industries, Inc. (L-632)

CUSTOM MOLDING SERVICE. Booklet includes case history illustrations of custom molding products made by New Jersey company. Describes equipment for transfer, injection, compression molding. Shaw Insulator Company. (L-633)

MARKING MACHINE. Illustrated data sheet describes machine for marking letters and numbers on plastics materials, metal parts, nameplates. Available in several die sizes. The Acromack Company. (L-634)

WELDER FOR THERMOPLASTICS. Data sheet describes electric welder for use with plastics pipe, fittings, sheet materials. Includes specifications, prices. The Seelye Craftsmen. (L-635)

CUTTER AND SLITTER FOR FILM. Folder describes machine for shear cut, razor blade and rotary burst type cutting of plastics film, and tape, foil, paper. Can operate at speeds up to 1000 feet per minute. Includes illustrations of principal parts, specifications. John Dusenbury Company. (L-636)

VACUUM PUMPS AND GAUGE. Illustrated literature describes mechanical booster high vacuum pumps with capacities of from 1000 to 12,000 cubic feet a minute and speeds of from 5 to 2200 microns, and an ionization vacuum gauge with range of .0001 to 1000 mm. Mercury. NRC Equipment Corp. (L-637)

HEATING CYLINDERS FOR INJECTION MACHINES. 32-page booklet describes company's extra capacity heating cylinders, designed to increase ratings on out-dated injection machines. Discusses construction, operation, installation, and maintenance. Injection Molders Supply Company. (L-638)

EXTRUSION COMPOUND FORMULATIONS. Technical bulletin describes eight formulations of PVC-50, a polyvinyl chloride polymer. Includes extrusion compounds for clear and opaque garden hose, shoe welting, and medical tubing. Chart includes physical properties. Diamond Alkali Company. (L-639)

CONTRACT MOLDING. Folder describes two-plant facilities and itemizes capital equipment of large Ohio compression, transfer, and injection molding organization. General Industries Company. (L-640)

STABILIZERS FOR VINYLS. Booklet gives data on properties, performance characteristics, and uses for line of stabilizers. Includes recommended formulations for calendered film and sheeting, extrusions, plastisols and organosols, rigid vinyls, and floor tile. Argus Chemical Corp. (L-641)

ROTARY KNIFE SCRAP GRANULATOR. Illustrated folder describes operation and illustrates construction features of rotary scrap granulator with models of capacities of 1 to 400 pounds per hour. American Pulverizer Co. (L-642)

ADHESIVES FOR FILMS. 18-page handbook discusses types, characteristics, applications, and methods of handling commercially available adhesives suitable for use on transparent film. Includes wall-size film selector chart. National Adhesives. (L-643)

FAR-INFRARED HEATERS. Illustrated brochure describes in detail the features and advantages of "Chromalox" electric radiant heaters, shows many actual installations, list specifications and prices. Edwin L. Wiegand Company. (L-644)

Fill out and mail this card now

Postage Will be Paid by Addressee

No Postage Stamp Necessary If Mailed in the United States

BUSINESS REPLY CARD

First Class Permit 2656 (Sec. 34.9, P.L. & R.), New York, N.Y.

MODERN PLASTICS

Village Station Box No. 103

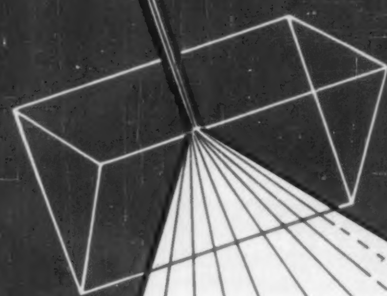
NEW YORK 14, N. Y.

Investigate

CONOCO H-300

the extender of profit

SECONDARY PLASTICIZER



demonstrates exceptional light stability when used with polyvinyl chloride formulations

Conoco H-300, in addition to possessing a number of other outstanding properties, is unique in its stability to discoloration caused by exposure to light. Fadometer tests prove that films containing H-300 show light stability *equal to or better than* those with no extenders. Just how economical it is may be seen from the fact that Conoco H-300 can be used to the extent of 25% of the total plasticizer required.

Conoco H-300 is available in either tank cars or drums.

Some of the other outstanding advantages of CONOCO H-300

- **Lower initial and aged viscosities in plastisols or organosols**
- **Improved mixing of formulations**
- **Greater low-temperature flexibility**
- **Saves as much as 2 cents a pound on the finished product**

Conoco H-300 is worth investigating. Write for your copy of the new Conoco H-300 booklet. Continental Oil Company, Petrochemical Dept., Division P-12 630 Fifth Avenue, New York 20, New York—1353 No. North Branch Street, Chicago, Illinois

CONOCO Petrochemicals *Petrochemical know-how from the ground up!*

CONTINENTAL OIL COMPANY

International

(*From p.* 123)

tions of some of the terms will be circulated to ISO member bodies as a Draft ISO Recommendation. The group will now undertake official definitions of the terms.

The Working Group on Mechanical Strength Properties submitted two new Draft ISO Proposals relating to the determination of the Charpy and Izod impact strengths of plastics and approved a test method for flexural properties of rigid plastics as a Draft ISO Recommendation.

The Working Group on Standard Laboratory Atmospheres and Conditioning Procedures revised two Draft ISO Proposals covering standard conditioning of plastic materials prior to testing and standard laboratory atmosphere for testing plastic materials to include three alternate sets of conditions, namely:

	Relative humidity	*Temperature*
Atm. A	65 ± 5%	20 ± 2°C
Atm. B	50 ± 5%	23 ± 2°C
Atm. C	65 ± 5%	27 ± 2°C

It was recommended that the ISO Technical Committee on Atmospheric Conditioning endeavor to obtain agreement on one standard atmosphere for all materials.

The Working Group on Thermal Properties prepared two Draft ISO Proposals for the determination of 1) melt flow index of polyethylene and polyethylene compounds and 2) incandescence resistance of plastics, and approved a method for the determination of the temperature of deflection under load for submission to the ISO Council for promulgation as an ISO Recommendation.

The Working Group on Physical Chemical Properties approved four test methods for circulation as Draft ISO Recommendations, namely: 1) determination of bulk factor of molding materials; 2) detection of free ammonia in phenolformaldehyde moldings; 3) determination of styrene in polystyrene with Wijs solution; and 4) determination of viscosity number of polyvinyl chloride

Consult Headquarters!

H. KOHNSTAMM & CO., INC.
Prime Manufacturer of

DRY COLORANTS

For More Than 100 Years

ATLAS COLORS

Our active association with technical groups of the basic producers of molding compounds and membership in the S.P.E. and S.P.I. keeps us abreast with the constant changes in and additions to the compounds being molded and colored by the molder.

This, plus the fact that we have been a prime manufacturer of dry colorants for over a century, puts us in the unique position of being recognized as a major factor in the field of dry color media for molding materials.

Send for our booklet.

It contains the answer to many of today's coloring problems.

H. KOHNSTAMM & CO. Inc.

Experts in Color Technology for More Than a Century
89 Park Place, New York 7 11-13 Illinois Street, Chicago 11
2632 East 54 Street, Huntington Park, California
Branches in other principal cities of the U. S. A. and throughout the world

MOLD STICKING?

USE

REAL-EASE

SILICONE

Release Compound

QUALITY: Highest-Uniform.

EFFICIENCY: Spray tailored for mold release use.

AVAILABILITY: Stocks in key cities.

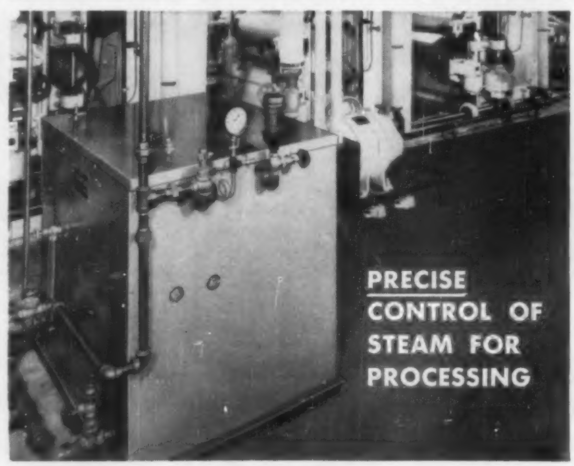
ECONOMY: Check these prices.

1 to 11 cans	$1.60 per can
1 to 4 cases (12 cans each)	$16.80 per case
5 to 9 "	15.60 " "
10 to 24 "	14.40 " "
25 or more cases	13.20 " "

GIANT 20 OZ. CAN

DON'T DELAY! ORDER TODAY!

BORCO CHEMICALS
3105 N. Cicero Ave. Chicago 41, Ill.



Accurate, reliable control of steam temperature is a "must" wherever steam is used as a heat source in plastics processing. A Pantex Speedylectric Steam Generator assures constant temperature "dry" steam "at the flick of a switch." Low in first cost and 98½% efficient, it utilizes the unique electrode principle of generating steam electrically. No flame or fumes, no fire or explosion hazard. 21 sizes, 2 to 60 Bhp. for operation on 220, 440 or 550 v. Write for Bulletin SG-100.

Pantex **MANUFACTURING CORPORATION**
Box 660R, Pawtucket 12, Rhode Island

resins in solution. They also considered ballots and comments received from 34 countries and approved four methods for submission to the ISO Council for promulgation as ISO Recommendations. These methods cover the determination of 1) water absorption of plastics; 2) apparent density of molding powders which can be poured from a funnel; 3) apparent density of molding powders which cannot be poured from a funnel; and 4) acetone-soluble matter of phenolic moldings. Another group of four Draft ISO Recommendations prepared by this Working Group are in the process of circulation to ISO member bodies for approval; these relate to the determination of 1) boiling water absorption of plastics; 2) methanol-soluble matter of polystyrene; 3) free phenols in phenol-formaldehyde moldings; and 4) free ammonia and ammonium compounds in phenol-formaldehyde moldings.

The Working Group on Aging, Chemical, and Environmental Resistance prepared three new Draft ISO Proposals covering the determination of the thermal stability of polyvinyl chloride and related copolymers and their compounds by 1) Congo red method, 2) discoloration method, and 3) a method for determining bleeding of colorants from plastics. They also approved three methods for circulation as Draft ISO Recommendations, namely: 1) change in weight and dimensions of plastics after contact with chemical substances; 2) loss of plasticizers from plastics; and 3) migration of plasticizers from plastics.

The 1957 meeting of ISO/TC 61 will be held in Switzerland, probably in July preceding or following the Congress of the International Union of Pure and Applied Chemistry. The committee also accepted the invitation to hold the 1958 meeting in the United States. According to present plans this meeting will be held in Washington in October or November; a symposium on plastics will be held in Atlantic City during this same period under the auspices of A.S.T.M. Committee D-20 on Plastics and other technical plastics organizations.

The Division of Plastics and High Polymers of the International Union of Pure and Applied Chemistry held a two-day meeting in Delft, Holland, on September 24-25. Classification systems, identification tests, and abbreviations for plastics were discussed. A review of classification systems prepared by R. Houwink and H. Bouman is to be printed and distributed to producers, users, and technical groups for comments and recommendations. The IUPAC Documentation Committee will be requested to sponsor a symposium on classification of plastics.

Plans were discussed for a symposium to be sponsored by the Division in Paris on July 25-26, 1957, immediately following the IUPAC Meeting and Congress. The symposium title will be "Structure-Properties Relationships of Polymers (Fundamental Considerations Relating to the Testing of Polymers)."—End

Vinyl cast on paper

(From pp. 126-127)

of casting is that extremely thin films (as low as 1 mil) may be combined with very lightweight fabrics. The cast vinyl stays up on the surface of the fabric where it belongs, and doesn't "soak" down into the fibers. With the paper support, the thin combination can be made free from stresses that are likely to be induced by the web tensions of the conventional lamination process.

11) Fewer coating operations. Many fabric coaters process their material a number of times in order to build up the desired film thickness and continuity. Cast vinyl on a paper carrier can be made in one pass to the desired thickness or weight, and then laminated to the fabric in a single operation.

12) Long or short runs. While long runs are quite easily attained through splicing the ends of 3000-yd. rolls of paper and using a festoon or lapping arrangement at the end of the drying oven to allow dwell time for the handling of cured rolls, runs as short as 300 yd. in different colors may be handled quite easily on paper carriers. One company finds it advantageous to cast films up to 20 mils thick on fabric in short runs and in different colors.

These dozen factors illustrate why there is such a growing interest in the casting-vinyl-on-paper process. A great deal still needs to be learned about the economics of the method.

In general, it is thought that cast film can't compete with calendered film when the thickness exceeds 6 mils, but there are many exceptions to this rule. Likewise there are few firm charted rules concerning speeds. Speed is limited by the film thickness and oven capacity; and there is a further consideration of the weakening effects of high heat on the paper fibers. Where ovens are long enough, film can be cast on paper carriers at speeds well over 100 ft. per minute.

Plastisols and organosols

Both vinyl plastisols and organosols are used. The basic ingredients of a vinyl plastisol are vinyl resin, plasticizer, and stabilizer. Organosols, in addition to the above-mentioned components, contain volatile solvents.

In both types of dispersions, pigments, fillers, dyes, and other miscellaneous additives may be incorporated into a specific formulation. The proper selection of ingredients permits the compounder to control tensile strength, elongation, hardness, flexibility, flammability, extractability, color, chemical resistance, opacity, cost, (as well as the working properties of the final) compound.

Film forming of these compounds is attained by fusing or coalescence of the dispersed particles of resin and plasticizer. Since this is obtained by heat, the drying or fusion is much faster than with most film-forming materials. This property lends itself readily to the high-speed production of cast films.

The decision regarding the selection of an organosol or a plastisol for casting purposes will depend to a great extent upon the properties desired in the end product and the equipment available. Organosols, because of their greater versatility, are probably used to a greater extent in film casting than the plastisol type of compound.

Plasticizers

Second to the vinyl resin in control of properties of vinyl dispersions is the plasticizer. Plasticizer type and content to a great degree control the properties of the fused film. The use of volatile thinners in organosols permits a wide flexibility of the amount of plasticizer that can be used in a given formula while still maintaining a uniform viscosity control; therefore, the physical properties of the cast film may be widely varied by the use of organosol compounds. Because of the nature of plastisol compounds, there is almost a complete lack of set-up until heated, as compared with an organosol which tends to start to set up as soon as it is coated, through partial loss of the volatile thinner. The organosol is therefore more readily kept on the casting surface.

There are, of course, disadvan-

tages in the use of organosols over plastisols. The organosols contain volatile thinners which must be removed prior to fusing. Normally this requires a three-zone oven with adequate exhaust system to remove the solvent. With plastisols, it is not necessary to zone the oven since the material may be brought directly to the fusing temperature from the coating head.

For casting of heavier-gage films, plastisols are generally used since higher-speed production can be maintained without the complication of slower evaporation of solvents in thicker cross sections. It should be kept in mind that these differences are all subject to control by formulation and by techniques of fusing and application.

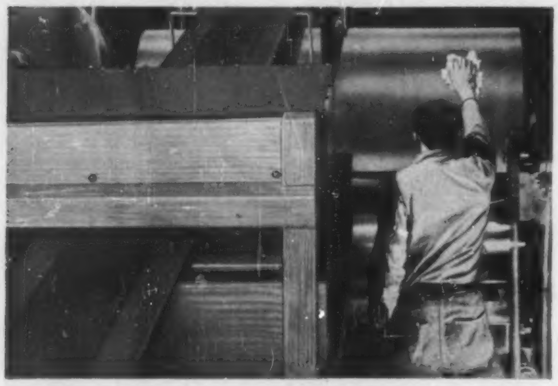
Oven temperatures

Final fusion of the vinyl dispersion is usually attained at temperatures of 400 to 425° F. Oven temperatures should be accurately controlled. Speed of coating will depend upon gage of film being produced, type of heating equipment, and method of application. Coating rates going as high as 400 ft./min. have been reportedly accomplished in production.

Applications of vinyl cast on paper carriers are already numerous. Much of the fancy transparent embedment-laminate material used for ladies' handbags is made with cast plastisol film. The material going into ladies' shoes is frequently similarly produced. The highly specialized materials for some of the more expensive automobile slip covers is vinyl film cast on a paper carrier. In the upholstery field a great deal of the storm jacket goods is produced by casting vinyl on heavy fabric and then embossing by roll. A lot of the knit fabric-supported automobile upholstery is currently being produced on a paper carrier.

As more companies take on this process and through constant and vigorous research turn what has until now been an art into a science, know-how will naturally be broadened and this versatile casting process will become even more economical.—END

"Extraneous metal parts are discovered!"



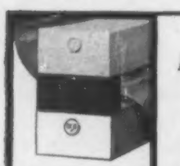
... thanks to our RCA METAL DETECTOR"

...Says Plastics Plant Executive

Metallic impurities not only cause defective areas in the finished sheet of polyvinyl chloride compounds, but they often render serious harm to processing equipment. "Extraneous metal parts present in raw materials are removed thanks to our RCA Metal Detector," says Mr. A. J. Hanley of Respro, Inc., Cranston, R.I. "A complete shutdown would be necessary for a period of 2-3 weeks or longer, if the metal damaged the calender rolls."

The RCA Metal Detector finds both magnetic and non-magnetic metals—even nickel, lead, brass and stainless steel.

Why take a chance on product rejects or costly shutdowns due to tramp metal? Protect your profits by installing an RCA Metal Detector in your plant.



MARK OF RCA *QUALITY*

ELECTRONIC

METAL DETECTOR

RADIO CORPORATION of AMERICA
Dept. M-75, Building 15-1, Camden, N.J.

Please send me complete information on the RCA Electronic Metal Detector for the Plastics industry.

NAME________________ TITLE________

COMPANY________________________

ADDRESS________________________

CITY________________ ZONE_____ STATE_______

---

we are manufacturers
. . . . NOT JOBBERS!

OF RIGID

CAST ACRYLIC PLASTIC SHEETS

Thicknesses—.030-.500
Sheet sizes up to 48" x 72"
First grade or S grade

We specialize in closer tolerance and harder surface for greater abrasion resistance.—Also other special formulations.

If you are a fabricator, jobber, or end user, contact us for immediate delivery from stock.

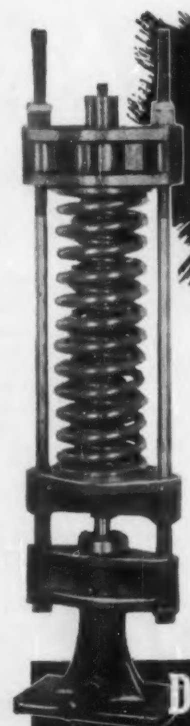
A SECOND SOURCE OF SUPPLY IS INVALUABLE.

CAST OPTICS CORPORATION
121 NEWMAN ST.
HACKENSACK, N.J.
HUbbard 9-4000

Manufacturers of COCOR • BRAND Plastic Sheets

COCOR® Registered Trademark of Cast Optics Corp.

PROTECT Hydraulic Systems from SHOCK



Keep the shock of a quick-closing valve from pounding your hydraulic system to pieces. Avoid unnecessary leaks. Cushion the blow with a Dunning & Boschert Shock Alleviator.

Loosely coiled, nested springs allow a full eight-inch piston travel. Steel tube inside the inner spring prevents buckling. Moving platen is guided by strain rods which are threaded to permit easy adjustment of pressure. Steel cylinder; bronze gland; 2-in. stainless-steel piston.

Here's a sound investment in longer service life — lower maintenance costs. Write for complete information.

Dunning & Boschert PRESS CO., INC.
331 W. WATER ST., SYRACUSE 4, N. Y.

Polyethylene fibers

(*From pp. 132-135*)

turers who have developed such fabrics is U. S. Rubber Co., who markets it under the tradename Trilok. Another firm, Collins & Aikman Corp., New York, N. Y. is producing similar-type three-dimensional fabrics under a licensing agreement with U. S. Rubber. In addition, the firm is now making its own novelty pile yarns by wrapping binder ends of polyethylene monofilament around core yarns of non-shrinkable textile yarns which, when woven in a fabric as pile, and then dyed, allow the polyethylene to shrink and permit the core yarn to spread out and create a textured effect. Patents for this process have been applied for. Both firms use Reevon branched-type polyethylene filaments. Dawbarn is supplying Deering & Milliken, New York, N.Y. with high-shrink branched polyethylene for the production of 3-D fabrics.

These three-dimensional textiles have automotive and furniture upholstery applications. The 1957 Oldsmobile hardtop line, for example uses Trilok fabric as original upholstery, and other car makers are experimenting with the material. It is also being used for the interiors of the D-58 Sikorsky helicopters now in shuttle service between New York airports.

This market is in its early infancy and volume figures have no significance as yet. However, industry spokesmen estimate that by 1960 annual resin consumption will have reached or topped the 2-million lb. mark.

Polyethylene textiles: Probably the largest market potential for polyethylene monofilament is in the automotive, outdoor and office furniture, and institutional fields as upholstery materials. Golf bags and awnings are also possibilities. If polyethylene can crack these markets, it is estimated that consumption for these applications alone might run at a 10-million lb. annual clip.

In the United States, the attempt to introduce woven polyethylene of the branched type as a seat covering material (both automotive and outdoor furniture) ended in failure. While both shrinkage and light-stability problems had been solved, the material was not strong enough to stand up under the heavy abuse that these coverings must take. The market was taken over by saran and nylon. (In Europe, the experience proved to be somewhat different and woven branched polyethylene filament found a limited market in automotive upholstery.)

However, today the picture is changed. Strength and abrasion resistance of linear polyethylene are equal or superior to those of saran and approach those of nylon. Numerous firms are presently testing it for these applications and preliminary indications are that the tests will be successful.

Miscellaneous applications: There are several low-volume uses of polyethylene monofilaments which will not be particularly affected by the introduction of linear-type materials. These include some of the fabrics used in electroplating and as battery

Table I: Comparative physical property values (*approximate*) of several fiber materials

Material	*Specific gravity*	*Tensile strength*	*Tenacity*	*Ultimate elongation*	*Melting point*
		p.s.i.	*g./denier*	*%*	*°F.*
Branched polyethylene[a]	.92	18,000	1.7	50	230
Saran	1.7	45,000	2.5	30	260
Nylon	1.14	100,000	7	20	480
Linear polyethylene	.96	85,000	6	15	265
Polypropylene		100,000	7	35	350

[a]Prior to the introduction of linear polyethylene filaments, extruders in several cases modified their extrusion material to improve properties. Reeves Bros., for example, introduced a branched-type filament (under the trade name of Reevon) with a tensile strength of 26,000 p.s.i., tenacity of 2.2, ultimate elongation of 25%, and melting point of 245°. Dawbarn Bros. and National Plastics report the availability of fibers with similar properties.

FRENCH HYDRAULIC

Compression and Transfer Molding Presses

Standard sizes designed and built to your specifications

•

254 ton bottom transfer molding press
18" ram diameter
30" daylight
24" x 24" pressing surface

This side plate molding press is the ultimate in equipment where press rigidity, low maintenance, and molding accuracy are required. Good equipment can:

- ✓ Increase production
- ✓ Decrease scrap losses
- ✓ Improve quality of molded product
- ✓ Improve close tolerance molding
- ✓ Reduce mold maintenance
- ✓ Minimize press maintenance

Buying high quality French molding presses adds up to increased profits for you.
Send for illustrated bulletin.

THE FRENCH OIL MILL MACHINERY CO.
(HYDRAULIC PRESS DIVISION)
1000 GREENE ST. PIQUA, OHIO

another product improved . . .

Hob-Nob* gloves are manufactured by the Wells-Lamont Corporation, Chicago.

*Reg. trademark

chem·o·sol®

puts the **safety grip** *in the glove*

Make a good product better with **chem-o-sol**, the plastisol formulation with unique properties!

Shown above is a cotton work glove which Wells-Lamont Corporation of Chicago has converted into a superior, better-selling product through an ingenious application of **chem-o-sol**. This **chem-o-sol** was specially formulated to permit printing on fabrics at high speeds.

Palms and fingers of the gloves are strategically dotted with **chem-o-sol** to give a firm slip-proof grip on any tough job. Flexibility and "feel" are unaffected, while wear-ability is greatly increased.

Possibilities for new and improved products through use of **chem-o-sol** are unlimited. This easily manageable liquid vinyl dispersion forms a tough flexible solid with high abrasion resistance. Available in practically any color, it is readily applied in mass production by dipping, molding, spraying, die-wiping, knife-coating or roller-coating.

Our completely equipped laboratories and experienced chemists stand ready to assist you in formulating the *exact* **chem-o-sol** to solve your product problem.

Bulletin 141 tells what **chem-o-sol** *is, how to use it, what it can do for you. Write for your free reference copy today.*

Chemical Products CORPORATION
KING PHILIP ROAD • EAST PROVIDENCE, R.I.

separators; and as controlled-diameter filaments in the construction of electric cables.

Prospects

One of the problems that has been noted with linear polyethylenes is its low resilience.

In one approach to this problem, Dawbarn Bros. has been extruding 1-mil polyethylene ribbon in varying widths and twisting it into "ribbon yarn" which is then used instead of the extruded monofilament. According to Dawbarn, not only does the ribbon yarn improve the resilience of materials made of it, but it also has better coverage than monofilaments and has knitting properties approaching those of multifilament yarns. Fabrics woven from such "yarn" are being currently being evaluated.

Reeves Bros., tackling similar problems, is investigating, among other developments, the recently introduced intermediate-density polyethylenes (ICI's Alkathene HD, Spencer Chemical's Poly Eth HiD and one similar polymer of Eastman Chemical). These branched-type polyethylenes have a density of about .94 (midway between conventional and linear polyethylenes), are stronger than conventional types of high-pressure polyethylene, and possess better elastic recovery.

While the new polyethylenes are rapidly expanding the monofilament market, prospects of even further expansion are in store once the newly developed polypropylenes can be evaluated. Initial reports from Europe indicate strength characteristics that may be equal or higher than those of linear polyethylene.

References

Willert, W. H., "How to extrude, orient, anneal, wind polyethylene monofilaments," MODERN PLASTICS 27, 87 (July 1950).

"Plastics learn the ropes," MODERN PLASTICS 31, 90 (March 1954).

"Fabrics with depth," MODERN PLASTICS 33, 226 (April 1956).

Erlich, V. L., "Polyethylene fiber today," Modern Textiles 37, 33 (May 1956).

Erlich, V. L., "Polyethylene's growing uses." *ibid*, 37 (June 1956).—END

Not as easy

(*From pp.* 129-131)

of the rows of plugs need be mounted on the drape frame.

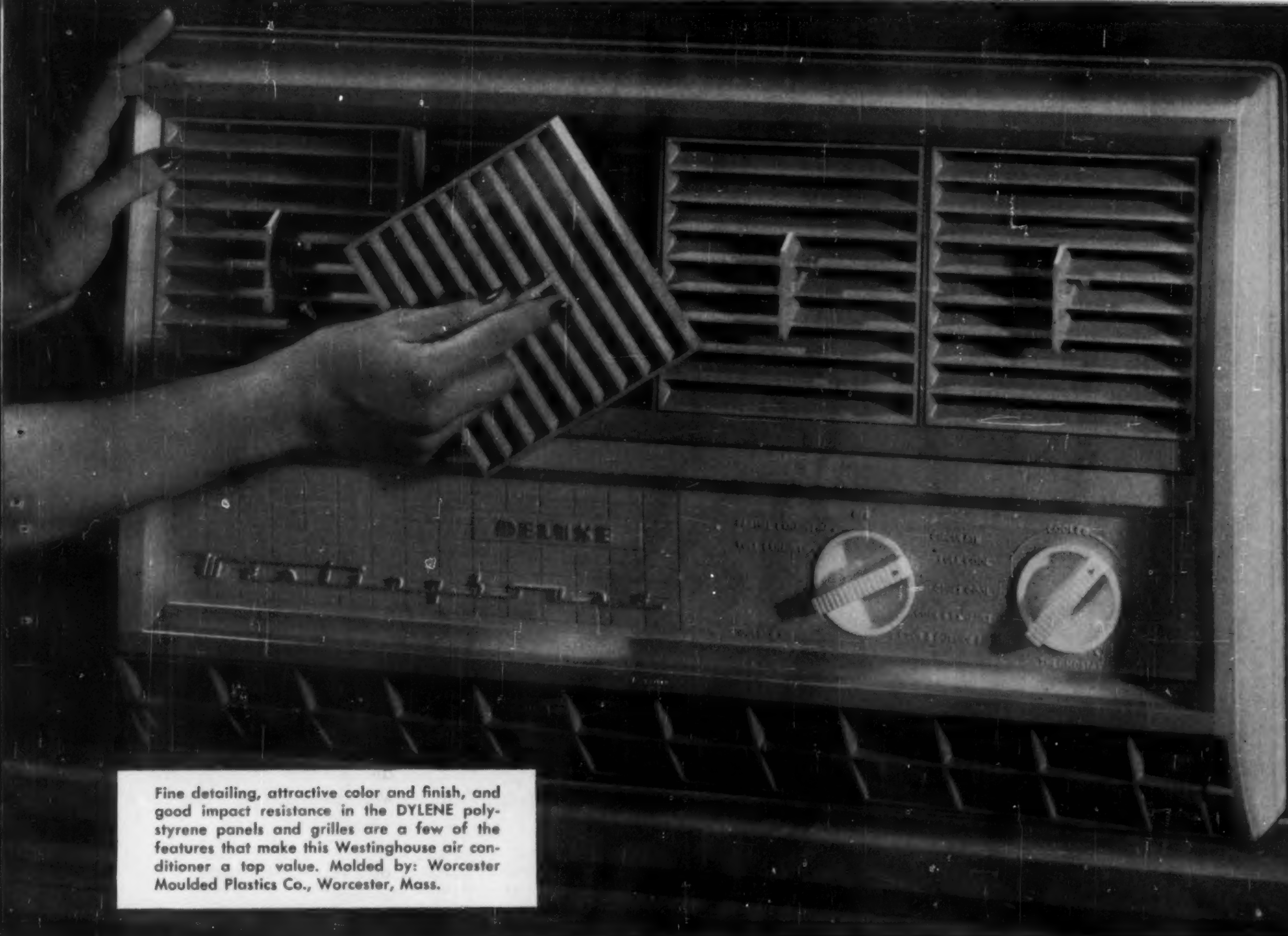
The actual forming of the polyethylene end caps presented no particular problems. A 25-sec. heating cycle and a 40-sec. cooling cycle was used.

Where Nordic came across their next major problem was in the die cutting of the formed caps from the sheet. Originally, a 20-up clicker die was designed for the job. Because of the flexibility of the polyethylene sheet, however, Nordic could not get the 1/16-in. flange to come out even all the way around nor could a clean cut be obtained. At first it was thought that the combination of a soft sheet and a wooden cutting block was causing the difficulty, but even when aluminum and steel cutting plates were used, results still were not good. A steel rule die had little better success.

It was finally decided to use a 5-up male and female punch-press die and again the decision paid off. When the formed sheet is removed from the mold, it is first cut into 8 strips of 30 caps each. These strips are then fed into the die cutting machine. As the formed cap, with the raised side facing downward, passes under the die, a set of male plugs comes down into the cavity of the cap to position it for die cutting. The entire male half of the punch press then moves down. A knife edge on a notched shoulder in the male half mates with a protruding edge in the female half to cut the flange off cleanly. After die cutting, the male plugs descend further to push the finished piece out of the strip. It is reported that some 40 to 50 thousand pieces can thus be die cut in an 8-hr. day.

The ingenuity thus displayed in solving specific engineering problems arising out of the use of new plastics materials should enable the industry to grow in newer, more profitable directions.

Credits: End caps are formed from polyethylene sheet supplied by The Gilman Bros. Co., Gilman, Conn. Fura-Tone resins for molds supplied by Irvington Div., Minnesota Mining & Mfg. Co., Irvington, N. J.



Fine detailing, attractive color and finish, and good impact resistance in the DYLENE polystyrene panels and grilles are a few of the features that make this Westinghouse air conditioner a top value. Molded by: Worcester Moulded Plastics Co., Worcester, Mass.

Westinghouse makes sure . . . with **DYLENE**® polystyrene

Finely detailed lettering and design—clean, smooth panel edges—attractive colors—glossy finish and resistance to impact. All of these qualities are found in the polystyrene panel and louvers of the Westinghouse Deluxe Air Conditioner. They are notes of quality that help this product live up to Westinghouse's famous "You can be sure . . ." slogan.

DYLENE polystyrene plastic was chosen as the molding material for several good reasons. It molds easily and sets up fast. DYLENE allows use of fine details such as the ⅛-inch-high raised lettering, and it resists cracking or chipping when the spring-held louvers are allowed to snap into position. DYLENE is colorful and has a finish that is attractive to both touch and sight. No wonder it is used by one of the country's foremost makers of appliances. You, too, can make sure with DYLENE polystyrene.

Koppers also produces DYLITE® expandable polystyrene, DYLAN® polyethylene and SUPER DYLAN* polyethylene. For more information on any of these four fine plastics, write to Koppers Company, Inc., Chemical Division, Dept. MP-126, Pittsburgh 19, Pennsylvania.

*Koppers Trademark

KOPPERS

KOPPERS PLASTICS

Sales Offices: PITTSBURGH · NEW YORK · BOSTON · PHILADELPHIA · ATLANTA · CHICAGO · DETROIT
HOUSTON · LOS ANGELES · SAN FRANCISCO · In Canada: Dominion Anilines and Chemicals Ltd., Toronto, Ontario

Tough pumps

(*From pp. 136-138*)

the plating industry (to handle corrosive electrolytes), sewage plants, and the cosmetics industry. Vanton's plastics pumps can even be adapted to the highly abrasive slurries commonly encountered in the tile and pottery field.

Food stuffs, e.g., soft drink syrups, mustard, vinegar, etc., are also easily handled by the pumps without contamination or imparting foreign odors or tastes. Along the same lines, the pump can be used for plasma or whole blood; in addition, use of clear acrylic for the body block enables visual inspection of the fluid as it passes through the pump.

To extend areas of application even further, Vanton recently announced production of a fluorocarbon elastomer (Kel-F) liner and is experimenting with the high-density polyethylenes (of especial value because of their higher temperature resistance). Also in the works for the Vanton pump is a rotor molded of a reinforced plastic molding compound (polyester-glass). As a replacement for the current stainless steel model, the reinforced plastic rotor offers the advantages of lighter weight, better resistance to corrosion, and durability under stress.

All-polyethylene pump

In the design of the more basic hand pumps, the concept of an all-plastics unit is already a reality. Bel-Art Products, West New York, N. J., for one, recently introduced a hand pump which is fabricated entirely of polyethylene, with the exception of a steel handle rod—and that is completely encased in polyethylene. Operating like a conventional bicycle pump, the polyethylene pump is designed to facilitate removal of liquids from drums, tanks, carboys, and open bulk containers. It can deliver a gallon of liquid in a few seconds and will empty a drum to within ⅛ in. of the bottom.

To form the pump, ten polyethylene parts (including injection molded caps and extruded handles, barrels, and delivery tubes) are welded permanently together. The intake and outlet valves consist simply of die-cut disks of 1/32-in. polyethylene sheet welded at only one point to the main body components, thereby forming an effective hinge. Because of its all-polyethylene construction, the hand pump is inert to strong acids, alkalies, and most organic solvents. It has already been mechanically tested for over 100,000 continuous cycles without any sign of failure.

Although originally intended only for laboratory use the pump is today being used in the fields of photography, photo-engraving, plating, chemicals, and pharmaceuticals. It is available in a number of sizes—from a 24 in. to a 36 in. long barrel—and can be supplied mounted in a standard 2-in. threaded polyethylene plug which screws into polyethylene carboys and drums to make a complete easy-to-use unit.

A similar type of hand-oper-

ated pump for laboratory use is being fabricated of rigid vinyl by American Agile Corp., Maple Heights, Ohio. Like the polyethylene model, the vinyl pump is made up of extruded and molded sections welded together. It has a capacity of 30 gal./hr. at an average pumping rate of 45 strokes per minute.

Case studies in pump design

No matter how tough the pumping job involved, there is generally a plastic material available to cure most troubles. Case study reports from some of the country's leading pump manufacturers emphasize the point.

Polytetrafluoroethylene: Chempump Corp., Philadelphia, Pa., reports that standard gasketing material on practically all the pumps it builds is Teflon polytetrafluoroethylene (supplied by E. I. du Pont de Nemours & Co., Inc.). The material is generally used in the form of an envelope-type gasket in which layers of Teflon sheet are placed on either side of a corrugated stainless steel doughnut. In applications where corrosive or other hard-to-handle fluids are involved, a Teflon shaft sleeve is also used.

Polyethylene: For one of the newer pumps being marketed by Gorman-Rupp Industries, Inc., Belleville, Ohio, both housing and impeller are molded of Tenite polyethylene (supplied by Eastman Chemical Products, Inc.). Because of the corrosion resistance, inertness, and strength of the polyethylene components, end-users have found the pumps useful for handling a number of tough pumping jobs. For example, they have proved particularly well suited to the household appliance field (clothes washers and dryers, dishwashing machines, etc.) where the polyethylene parts show long life despite daily exposure to detergents, bleaches, and alkalies. When used in vending machines, the pumps can handle beverages without impairing delicate flavor, color, and clarity. In photo-developing units, they can pump water, hypo, and acid solutions without affecting sensitive photographic fluids or emulsions, and in still another specialized application, the pumps have been used for carrying antifreeze solutions at temperatures of −80° F.

Nylon: In the Dolphin submersible pump developed by The Dayton Pump and Mfg. Co., Dayton, Ohio, nylon and stainless steel have replaced brass as the basic construction material. All moving parts within the pump that are subject to abrasion, including the impellers, are molded of nylon. According to the company, nylon was selected for the application because of its strength, its dimensional stability, and the fact that it can absorb the shock and impact of sand and other foreign particles in the water. As a result, the redesigned pump has proved considerably more effective even when used in wells ranging up to 500 ft. in depth.

Styrene: On controlled-volume pumps for low-pressure, moderate temperature applications, Milton Roy Co., Philadelphia, Pa., is currently using molded Plio-Tuf styrene valve units (supplied by The Goodyear Tire and Rubber Co., Chemical Div.) instead of metal. By using the plastics units, the pump can now be adapted to process applications involving acid, caustic, and resin solutions, and other corrosive fluids. Lower materials costs also result in substantial savings in production.

The styrene valve units are located on one end of the controlled-volume pumps to accommodate the movement of corrosive liquids through a fluid system by positive displacement action. Pumps incorporating the valves can be used for temperature applications up to 160° F.

Although corrosion resistance is the dominating factor behind the selection of plastics materials for the pumps just described, many cost advantages are also inherent in the switch from metal to plastics. By molding the plastics parts in one piece, much of the cost involved in tooling up for a number of small metal parts, machining them, and assembling them into the finished product is drastically reduced—one more reason why pump manufacturers have accepted plastics as the most economical materials of construction in building tough pumps for tough jobs.—END

For Premium Vinyls

WHEN QUALITY COUNTS...COUNT ON HERCOFLEX 150

TELEPHONE COIL WIRES must have "just right" spring, low-temperature flexibility, and other premium properties. For such quality uses, Hercoflex 150 has a proven record as an ideal plasticizer for the outer plastic coating.

AUTOMOBILE UPHOLSTERY which must meet the challenge of wide temperature ranges is another application where the outstanding characteristics of Hercoflex 150 insure dependable vinyl performance.

Indoors or out, hot or cold—wherever quality vinyl plastics are needed, Hercoflex 150 is tailor-made to provide premium properties that mean longer lasting products.

But no one plasticizer can meet all the requirements of vinyl processors. That's why Hercoflex 150 is just one of Hercules' family of Hercoflex plasticizers. Whatever you seek in a plasticizer, one member of this versatile group is sure to meet your specific requirements with "custom-made" precision.

If your files are not fully up-to-date on the Hercules plasticizers, write for the latest information. Or—if you have a specific problem, tell us your requirements, and we'll suggest the best answer based on our own experience.

HERCOFLEX®
VINYL PLASTICIZERS

Synthetics Department
HERCULES POWDER COMPANY
INCORPORATED
916 Market St., Wilmington 99, Del.

SH56-3

Mold temperature

(From pp. 149-160)

techniques. The amount of improvement, however, would probably vary, with less effect at higher cylinder heats. We must remember that these higher strengths are the result of increased orientation in the direction of flow. Although it was not encountered here, warpage might then tend to become more of a problem, along with environmental stress cracking. In all cases studied, appreciably faster cycle times were observed at the lower mold temperatures. Transparency of the part was increased in every case where the mold surface actually was cold. The importance of this property seems to be limited to thinner sections that are molded from higher-MI materials.

Restricting the use of cold mold temperatures is the resulting decrease in surface gloss. This may be considered of greater significance when using highly polished mold surfaces. Cold molds also offer more resistance to plastic flow. This may be easily corrected by slight increases of temperature or pressure. Of great importance is the likelihood of moisture condensation which could make it impossible to run on many summer days unless the shop is air conditioned. In order to obtain maximum benefit, the mold cooling must be efficient enough that the actual metal surface can be maintained at low temperatures. Even where this is not possible, however, one might still expect somewhat faster cycle times. Also, for cold mold operation, additional mold cooling capacity would probably have to be purchased.

All and all, then, it would appear that cold molding techniques can give better looking and stronger parts at faster cycles. However, after studying the above limitations, it would seem that cold molds would be most beneficial in producing smaller, thin section moldings using high-melt-index materials. These molds could be more easily constructed with more efficient heat transfer and would require less mold cooling capacity.

Plastic toilet bowls

(*From pp. 164-165*)

ester gel coat of the same formulation as used for the surface coat on the castings.

The completed fixture was then fitted to a standard flush valve and tested. The flushing action and wash down was excellent and performance was identical with the ceramic prototype. Figure 5, p. 166, shows the completed plastic fixture with seat.

This plastic toilet performed entirely satisfactorily and was easy to keep clean. It has not been in service long enough to permit a good estimate of its resistance to the repeated assaults of cleaning agents. However, a sink made of similar materials has been used daily for two years by 6 to 12 persons. During this time the janitor has scoured it just as he does ceramic sinks. To date, the surface is as smooth as the day it was installed though it lacks luster. Another sink for kitchen service, installed at about the same time in a local cafeteria, still seems as good as new.

Future developments

Epoxies may be used in place of polyester resins in order to get harder surfaces; pending the results of long-term service testing, this may or may not be necessary. While the toilet described here had to be made in three pieces in order to get an exact replica of the ceramic bowl, a complete re-design job would probably result in a very satisfactory bowl that can be molded in one piece in matched-metal molds. This would make possible savings in both weight and production costs in reasonably large-scale production. The present model weighs 15.3 lb. as against 33.9 lb. for the ceramic prototype. Fixtures 8 or 10 lb. are feasible.

It is estimated that in mass production quantities the reinforced plastic toilet bowl will cost between $9 and $15, depending on the design and process utilized. This compares favorably with ceramic, and the plastic bowl offers many advantages. Plastic bathtubs, sinks and shower stalls are already being retailed. Plastic toilets are sure to follow.

Stereospecific

(*From pp. 169-182*)

trans 1,4-links. The conditions for the production and isolation of crystalline poly-α-olefins (11) and the preparation of highly stereospecific catalysts (12) have already been published in several Italian patents (27). Meanwhile, Ziegler (29) also applied for a patent on the production of high molecular α-olefin polymers, but without studying the steric structure of the polymers.

As already stated in our first publications in this field, the stereospecific catalysts used so far for the preparation of isotactic α-olefin polymers are characterized by the presence of a solid phase, i.e., they are heterogeneous. The term "solid phase" here has a wider meaning, including certain catalysts of colloidal dimensions, especially microcrystalline.

Typical catalysts, acting according to an anionic mechanism, are those obtained by treatment of solid crystalline halides of transition elements in an oxidation state lower than the maximum (see previous section) with metal alkyls. Only a rather small amount of metal alkyl is required for highest catalytic activity, of the order of 0.1 mole AlR_3 per mole of transition metal halide. However, an excess of the metal alkyl is preferable because it protects the catalyst by destroying traces of oxygen and moisture, which are catalyst poisons. Applying the nomenclature of cationic catalysis, the transition metal compound can be called the catalyst and the aluminum trialkyl or dialkyl aluminum hydride are cocatalysts.

The use of metal alkyl compounds is not absolutely necessary but is convenient and effective for the preparation of stereospecific catalysts with an anionic mechanism. The formation of metal hydrogen bonds on the catalyst surface can be sufficient; such bonds are polarized in the direction of hydride ions, capable of forming carbanions with olefins; thus, even the surface of a transition element can be catalytically active provided the formation of metal alkyl bonds can be initiated by a surface oxidation.

Our idea of the orienting action of certain solid catalysts in the stereospecific catalysis leading to production of isotactic polymers is in line with the investigation of products obtained by other polymerization processes that yield small amounts of high-melting polymers, whose structure was later proved to be isotactic.

We have shown that the crystalline polymer obtained by Schildknecht by polymerization of vinyl ether with BF_3 (24) at low temperature (—80° C.) is in fact isotactic (9, 10, 25). Boron fluoride as catalyst is known to require a cocatalyst (e.g., traces of water) and to form solid compounds easily (e.g., with water) at low temperatures; therefore, it is not impossible that here the formation of isotactic polymers is also related to the presence of a solid catalyst. Schildknecht himself had observed that the crys-

talline polymer is formed by heterogeneous catalysis.

In polymerization products prepared with Phillips catalysts (34), the small fractions of solid polymer were proved (15) to have a certain crystallinity due to the presence of isotactic chain segments, though these polymers have a rather low molecular weight and a melting point lower than highly crystalline polypropylene of high molecular weight. We suggest their formation is due to a solid phase containing a compound of hexavalent chromium which is reduced to a lower oxidation state by the olefin. The content of isotactic polymer is increased by treating the Phillips catalyst with metal alkyls, but remains only a small fraction of total polymer (15).

The adsorption of the reactants on the catalyst surface certainly is highly important in heterogeneous catalysis; it can force the adsorbed molecule into a definite orientation relative to the growing chain linked to the active centers of the catalyst.

A dissolved or very finely dispersed catalyst leads to the formation of non-isotactic molecules. We ascribe this to the absence of a solid orienting surface which would force the monomer molecules to arrange themselves only one way relative to the growing chains.

When the probability of a defined arrangement of the molecules is fairly high but not exclusive, polymers will be formed with longer or shorter isotactic chain segments.

Other stereospecific catalyses

The synthesis of isotactic polymers of α-olefins or conjugated diolefins with 1,4-structure, to give highly crystalline and high melting products, is a special case of stereospecific synthesis. Other stereospecific syntheses, e.g., that of syndyotactic polymers of olefins and conjugated diolefins with 1,2 or 1,4 cis structure, are also of considerable theoretical and practical interest. Every stereospecific synthesis requires orientation of the monomer molecule in a special activated form in relation to the end group of the growing polymer chain.

This orientation is determined, as mentioned before, by the adsorption of the monomer on a crystalline surface having a characteristically defined structure, thus leading to isotactic polymers. However, the size of this surface can be assumed to be very small, and in the limiting case the dimensions may be of the order of molecules, i.e., smaller than could be verified by X-ray methods.

An active center in anionic polymerization, a cation-carbanion link as part of a complex, is to adsorb a monomer molecule, to activate it, and to force it into a special orientation with regard to the growing chain; this condition can be predicted to assure a stereospecific polymerization. This assumption has proved to be widely applicable in the synthesis of certain stereoisomeric polymers of conjugated diolefins.

We have realized some syntheses of this kind by means of catalysts that consist of com-

plexes, contain transition elements, and act according to an anionic mechanism. Details of the nature of these catalysts will be published elsewhere.

References

1. G. Natta, Atti Accad. naz. Lincei. Mem. Serie VIII, Vol. IV, Sez. II, fasc. 4, 61 (1955).

2. G. Natta and P. Corradini, ibid., fasc. 5, 73 (1955).

3. G. Natta and P. Corradini, Atti Accad. naz. Lincei. Rend., Serie VIII, Vol. XVII, fasc. 1, 19 (1955).

4. G. Natta, P. Pino, P. Corradini, F. Danusso, E. Mantica, G. Mazzanti, and G. Moraglio, J. Amer. Chem. Soc. 77, 1708 (1955).

5. G. Natta, J. Polymer Sci. *16*, 143 (1955).

6. G. Natta and P. Corradini, Makromol. Chem. *16*, 77 (1955).

7. G. Natta, 4th World Petroleum Congress, Sect. IV/c, Preprint 13, Angew. Chem. *67*, 430 (1955).

8. G. Natta, Chim. e Ind. (Milano) *37*, 888 (1955).

9. G. Natta, Makromolekulare Chem. *16*, 213 (1955).

10. G. Natta, P. Pino, and G. Mazzanti, Chim. e Ind. (Milano) 37, 927 (1955).

11. G. Natta and P. Corradini, Atti Accad. naz. Lincei, Rend., Serie VIII, Vol. XIX, fasc. 5, 229 (1955).

12. G. Natta, P. Pino, G. Mazzanti, P. Corradini, and U. Giannini, Atti Accad. naz. Lincei, Rend., Serie VIII, Vol. XIX, fasc. 6, 397 (1955).

13. G. Natta, P. Corradini, and I. W. Bassi, Atti Accad. naz. Lincei, Rend., Serie VIII, Vol. XIX, fasc. 6, 404 (1955).

14. P. Corradini and I. Pasquon, Atti. Accad. naz. Lincei, Rend., Serie VIII, Vol. XIX, fasc. 6, 453 (1955).

15. G. Natta, P. Pino, E. Mantica, F. Danusso, G. Mazzanti, and M. Peraldo, Chim. e Ind. (Milano) *38*, 124 (1956).

16. C. C. Price, M. Osgan, R. E. Hughes, and C. Shambelan, J. Amer. Chem. Soc. *78*, 690 (1956).

17. C. W. Bunn, Proc. Roy. Soc. (London) A 980, 40 (1942).

18. M. E. Pruitt and J. M. Baggett, U.S. Pat. 2,706,181 (Apr. 12, 1955).

19. G. Natta, P. Corradini, and G. Dall'Asta, in press.

20. G. Natta, L. Porri, P. Corradini, and D. Morero, Atti Accad. naz. Lincei, Rend., fasc. 4 (1956), in press.

21. A. A. Morton, Ind. Eng. Chem. *42*, 1488 (1950).

22. G. Natta and L. Porri, in press.

23. Abstracts, Meeting of the Rubber Division of the Amer. Chem. Soc., Philadelphia 2nd-4th Nov. 1955: S. L. Horne, J. P. Kiel, J. J. Shipman, and V. L. Folt (B. F. Goodrich Co.); also F. W. Stavely (Firestone Tire and Rubber Co.).

24. C. E. Schildknecht, S. T. Gross, H. R. Davison, I. M. Laubent, and A. O. Zoss, Ind. Eng. Chem. *40*, 2104 (1948).

25. G. Natta, I. Bassi, and P. Corradini, Makromolekulare Chem. *18-19*, 455 (1956).

26. K. Ziegler, "Process for the Polymerization of Ethylene," Belg. Pat. 533,362 (German priority Nov. 16, 1953).

27. K. Ziegler, E. Holzkamp, and H. Breil, Angew. Chem. *67*, 541 (1955); K. Ziegler and H. Martin, Makromolekulare Chem. *18-19*, 186 (1956).

28. G. Natta, P. Pino, and G. Mazzanti, "Linear Crystalline High Polymers," Ital. Pat. 535,712 (June 8, 1954); "Production of High Polymers of α-Olefins with Regular Structure," Ital. Pat. 537,425 (July 27, 1954); "Production of High Polymers of α-Olefins with Preferential Structure," Ital Pat. 526,101 (Dec. 3, 1954).

29. K. Ziegler, "Process for the Polymerization and Copolymerization of Olefins," Ital Pat. 537,164 (German priority Aug. 3, 1954).

30. O. Klein and E. Lange, Z. Electr. Angew. Phys. Chem. *43*, 570 (1937); Landolt-Börnstein, Numerical Values Vol. I, part I (1950).

31. G. Natta, P. Pino, and M. Farina, Internat. Symposium for Macromol. Chem., Turin, Sept.-Oct. 1954, Ricerca Scientifica, special vol. 120 (1954).

32. G. Natta, E. Giachetti, I. Pasquon, Chim. e Ind. in press.

33. P. H. Plesch, Congress for Macromol. Chem., Nov. 1955.

34. Australian Patent 864/54; Belg. Pat. 530,617.—END

Climbing peel test

(*From pp. 187-190*)

such as: 1) requiring only an inexpensive apparatus, 2) peeling at a uniform rate, 3) load in the facing increases with increased peel resistance and is not affected by local facing deformation, 4) peeling to approximately a constant radius, 5) adaptability to tests at other than room temperature, and 6) no frictional losses within the apparatus that may affect the test value. Furthermore, the apparatus can be used to evaluate adhesive bonds in either sandwich or metal-to-metal constructions.

In the sandwich tests made to date, the average peeling strength for 3-in.-wide specimens varied from less than 10 to over 100 in.-lb. which corresponds to a peeling load from about 20 to 200 lb. for the apparatus used. In general, the radius of peeling was approximately equal to the radius of the drum, and the apparatus appeared to function most satisfactorily. This method of test ranked the peeling resistance of the various types of adhesives in approximately the same order as is obtained with other peel-test methods.

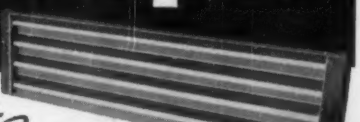
The peeling resistance of several metal-to-metal bonds was evaluated by the climbing peel test on 2-ply specimens of the type shown in Fig. 5, p. 188. The procedures described previously for sandwich materials were followed, but the specimen design, because of the nature of the materials, was necessarily different.

Specimens were prepared in the form of a panel made of 0.020-in. aluminum bonded to 0.064-in. aluminum, from which specimens were cut to 1¾-in. width. Grooves 1 in. apart were cut through the thinner face to the adhesive bond. The specimen was attached to a steel backing plate (to provide stiffness) and the 1-in. strip of thin metal was peeled from the rigid assembly in the same manner described for the sandwich specimens. A completed peel test is shown in Fig. 6, p. 190.

Average peeling strengths for sandwich and metal-to-metal specimens bonded with different adhesive systems are given in Table I, p. 190, and values are expressed in inch-pounds of torque per inch of specimen width. The apparatus, type of specimens, and techniques used in testing the specimens conformed with the recommendations for experimental procedures that were presented earlier.

This paper has discussed the principles of operation of the climbing peel tester and described in particular a specific application, the testing of aircraft sandwich materials with thin facings. The specific example discussed is not intended as a limitation of the design of the tester, or of the materials that may be tested, but merely as an example found to be suitable for the particular constructions involved. The apparatus, size of specimen, and testing techniques may be changed as desired to suit the requirements of different materials that are being tested.—END

New short-proof clepco

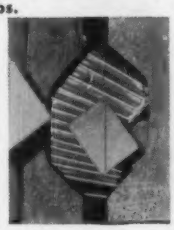


Fused Quartz

Radiant Heaters

For your difficult baking and drying jobs.

The most efficient radiant heater you can buy.



- BEST FOR PAINT BAKING
- BEST FOR PLASTIC FORMING
- BEST FOR FOUNDRY CORES
- BEST FOR TEXTILE DRYING
- BEST FOR PAPER DRYING

If you need a Clepco Radiant Heater you are paying for it every day.

2

SEND FOR COMPLETE INFORMATION

THE CLEVELAND PROCESS COMPANY

1965 EAST 57TH STREET • CLEVELAND 3, OHIO

CLEPCO

ALEXANDER
DEEP THROAT ENGRAVER

DOES PRECISE, 2-DIMENSIONAL WORK . . .

CAN HANDLE OVERSIZE WORKPIECES . . .

This excellent engraver handles workpieces up to 10″ tall, 38″ wide; on a work table 20x8″; auxiliary table 18x24″ can be attached if necessary. Ratios from 1:1 to 50:1; spindle has fine and coarse feed adjustments; cutters up to ¼″ dia.; speeds from 2800 to 15,000 rpm; ¼ h.p.; net wght. approx. 600 lbs.
Prompt delivery.

We have other engravers, and die-sinkers as well. Spindles, cutters, attachments, cutter grinders, and spare parts are stocked in New York. Write for catalog.

J. ARTHUR DEAKIN & SON

150-28 Hillside Avenue Jamaica 37, New York

Best deep-drawing qualities

Deep-drawn transparent packages made from

GENOTHERM

Rigid containers — round, oblong, oval, square or cylindrical — suitable for the packing of all kinds of food.

GENOTHERM — **the rigid PVC foil** entirely free of plasticiser and consequently physiologically unobjectionable and officially approved for packaging foodstuffs.

GENOTHERM — **the special type of PVC foil** with excellent deepdrawing qualities for vacuum-forming, blow-forming, and plug-forming.

GENOTHERM — **the rigid PVC foil** with an exceptional tensile strength, practically moisture-proof, unaffected by temperatures up to 176° F and with good transparency.

GENOTHERM — **the rigid PVC foil** is available colorless and in colored finishes, opaque or transparent and in all widths up to 32″.

ANORGANA G·M·B·H MÜNCHEN

Postal Address until further notice: (13b) GENDORF (OBB.)—WERK GERMANY

Sole Representation For U.S.A.:

David S. Greenfield, 3143 Decatur Avenue, New York 67, N.Y.

The Plastiscope

News and interpretations of the news

By R. L. Van Boskirk

Section 2 *(Section 1 starts on p. 45)*

Koppers design competition

A two-year, full-tuition scholarship heads the list of five scholarship awards in the 1957 Design Competition for Plastic Housewares, sponsored by Koppers Co., Inc. for the third consecutive year.

One-year scholarships will be awarded to first-prize winners in each of the four competition classes, and the winner judged "Best-of-Competition" will be awarded the two-year scholarship. The four classifications are: 1) polystyrene products for use with food; 2) polyethylene products for use with food; 3) polystyrene or polyethylene decorative products; and 4) polystyrene or polyethylene home maintenance products.

The scholarships will be granted in the name of the winning molder to a qualified college or university of his choice for studies related to industrial design. The college or university will select the student to receive the scholarship.

Entries in the competition will be accepted from either the molder or proprietary manufacturer of the eligible product, and the awards will be given to the originator of the design. Items entered in the competition may be molded, extruded, or fabricated of either regular, modified, or foamed polystyrene, or regular or modified polyethylene and must be in production for sale as a housewares product.

A production sample of each entry to be judged must be received no later than February 15, 1957 and should be addressed to: Administration Committee, Koppers Design Competition, 1313 Koppers Bldg., Pittsburgh 19, Pa. Entry forms may be obtained from the same address. Winners will be announced at an awards banquet in Pittsburgh on April 2, 1957.

Arc-resistant phenolic

A phenolic molding compound combining excellent dimensional stability with high arc resistance and good impact strength has been announced by Monsanto Chemical Co.'s Plastics Div., Springfield, Mass. The new material, Resinox 2200 Black, has been formulated specifically for use in heavy-duty electrical control parts and wiring devices. The compound is also particularly well suited for the manufacture of other parts requiring superior dimensional stability during severe temperature cycling, improved impact strength, and resistance to surface arcing, according to the company.

Pertinent property values include a shrinkage of 0.002 to 0.004 in./in.; minimum average arc resistance of 150 sec.; and impact strength of 0.40 ft. lb./inch.

High-powered solvent for vinyl

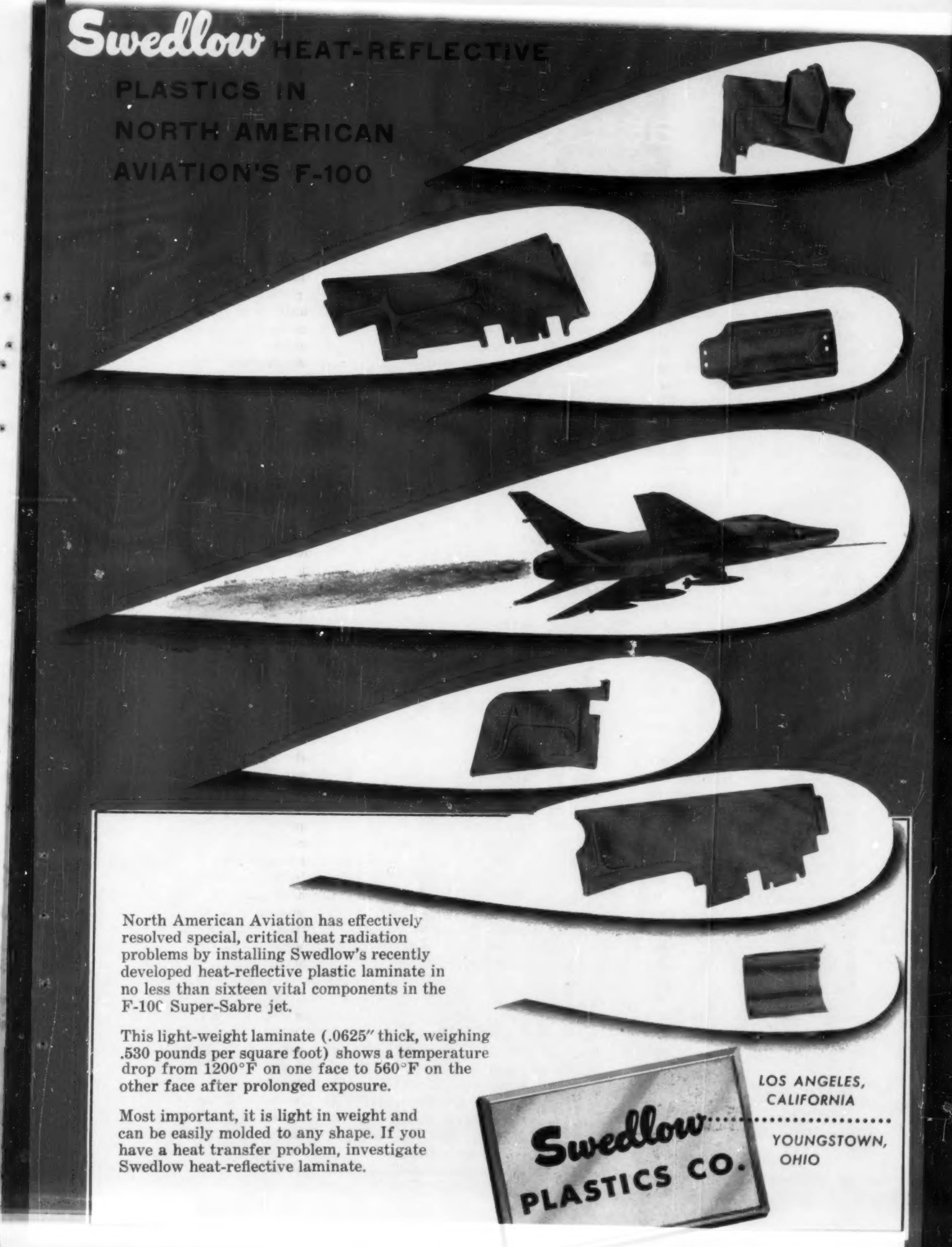
Expanded use of high molecular weight polyvinyl chloride resin and vinylidene chloride copolymers is made possible by Du Pont's comparatively new THF solvent. The high molecular weight resins, such as Geon 121, Bakelite QYNV, Exon 654, and Marvinol VR-10, offer greater tear and tensile strength, superior resistance to abrasion, flexing, moisture, and sunlight, but they are much more difficult to dissolve than lower molecular weight or the so-called solution resins. THF is suggested for use with high molecular weight resins to obtain better top coats for fabric coating, for adhesives where speedy sealing is important, as in joining vinyl chloride pipe sections, for vinyl coating resins, and in protective coatings. Even when resins are used that are easily soluble in such solvents as MEK, THF is useful because it permits a higher solids content.

THF is the short name for tetrahydrofuran. It is a furfural derivative produced from one of the chemicals used in making nylon. According to a Du Pont chart, about 14 lb. of a resin-like Geon 121 would require 86 lb. of THF to dissolve, but MEK and similar solvents would dissolve only a tiny portion of the resin. In the case of solution or "soft" resins, which require about 75 lb. of MEK to dissolve 25 lb. of resin, 60 lb. of THF will dissolve 40 pounds.

Sometimes mixtures of THF and other solvents show greater solvent power than either solvent alone. Thus a mixture of 65 parts of THF and 35 parts of dimethyl formamide would dissolve 18 or 19 lb. of high molecular weight resin compared to 14 when THF is used alone. A mixture of the two last named with MEK also produces a high rate of solvency. THF costs more per pound than most other solvents, but economy is possible through reduction of reject material and faster machine speeds. The solvent can be easily recovered. In all fields of use, THF is frequently extended with cheaper, less active solvents.

The principal use for THF thus far is in a topping coat on coated fabrics. In the early days of spread-coated vinyl fabric, top coats of solution resins, acrylates, and other materials were used but were dropped when the base resin was improved. However, the problems of crocking, blocking, migration, and marring are still frequently encountered. A top coating with high molecular weight resin dissolved in THF will help eliminate those problems. A typical structure, starting at the base, would be the fabric, 8 mils of a plastisol or calendered coating, and a 1-mil or less top coat, which is supplied by solvent solution. THF is also sug-

*Reg. U.S. Pat. Off.


Swedlow HEAT-REFLECTIVE PLASTICS IN NORTH AMERICAN AVIATION'S F-100
North American Aviation has effectively resolved special, critical heat radiation problems by installing Swedlow's recently developed heat-reflective plastic laminate in no less than sixteen vital components in the F-100 Super-Sabre jet.
This light-weight laminate (.0625" thick, weighing .530 pounds per square foot) shows a temperature drop from 1200°F on one face to 560°F on the other face after prolonged exposure.
Most important, it is light in weight and can be easily molded to any shape. If you have a heat transfer problem, investigate Swedlow heat-reflective laminate.
Swedlow PLASTICS CO.
LOS ANGELES, CALIFORNIA
YOUNGSTOWN, OHIO

The Plastiscope

gested for dissolving the resin used on 1-mil top coating for shoes.

Another growing use for THF is in vinyl chloride adhesives where high speeds are necessary, such as in the manufacture of raincoats, tubing, and toys. Rapid bite and quick evaporation are the advantages given by THF. Many times the THF can be used alone but only on rapid machine work since a rapid set-up of the solvent makes hand work difficult. In the case of hand work, mixtures of THF with higher boiling solvents are usually employed.

Still in development stage is the use of THF for cast vinyl film. If it proves successful, it may make possible the use of high molecular weight resins for cast film and may lower cost because of faster production. A low-cost cast vinyl film would certainly create a sensation in the vinyl industry.

New vinyl plant in operation

Production of vinyl resins has been started at its new Hicksville, N. Y., plant by Insular Chemical Corp. Insular Chemical is jointly owned by Rubber Corp. of America and Ross & Roberts Div., Pollak Industrial Corp.

Woodrow F. Wilson has been promoted by Rubber Corp. to vice president in charge of the Hicksville plant; Raymond J. Abramowitz is research director.

Grace to irradiate

World rights for the Hyrad process for irradiating polyethylene and other polymers have been acquired by W. R. Grace & Co. through an exclusive licensing agreement with Sequoia Process Corp., Redwood City, Calif. Irradiation can be used to modify and improve polymer properties. For example, when used on polyethylene, it improves heat resistance, reduces cold flow and stress cracking, and increases tensile strength.

Acquisition of the exclusive irradiation license by Grace implements its program now underway with the building of an $18 million plant in Baton Rouge, La., for the manufacture of a high-density polyethylene under license from Phillips Petroleum Co. The Polymer Chemicals Div. will supply polyethylene compounds and technical service know-how so that fabricators can use the process in manufacturing their own line of products. The process will combine the advantages of high-density polyethylene with the benefits of irradiation.

Plastics in Britain

The United Kingdom is now producing about ⅛ of the world's plastics output, according to P. A. Delafield, past chairman of the British Plastics Federation. Addressing a meeting of that group, he said that British production amounted to about 350,000 tons a year of the world's total 2.5 million tons. The latter will grow to 4 million tons in five years, Mr. Delafield thinks, and United Kingdom production will then be 500,000 tons.

In another paper presented at the Federation meeting, D. Radford, of the Federation Council, predicted that world output of polyethylene was now 150,000 tons and would reach 1.5 million tons by 1965.

Ed. Note: Mr. Radford is indeed conservative. The first six months production of polyethylene in 1956 in the United States alone was almost 260 million lb. or 130,000 tons; the last six months should be considerably more.

Pigment production

Large-scale commercial production of phthalonitrile in the United States will soon be started by Barrett Div., Allied Chemical & Dye Corp. The company has developed a process for producing the material in its laboratory and pilot plant facilities, and is constructing commercial-scale facilities at its Edgewater, N. J., plant. Completion of the new facilities is scheduled for the summer of 1957.

Phthalonitrile is used principally in the manufacture of metallic and non-metallic phthalocyanine pigments for plastics, inks, paints, etc. It is said to permit production of these pigments by more efficient means than the present method of manufacture.

Two-component urethane foam

A new division to provide two-component liquid systems, custom formulated to industry requirements, for the forming of urethane foam materials has been established by Dayton Rubber Co., Dayton, Ohio.

Mixed together, the two liquids form either flexible or rigid urethane foam materials in varying densities, depending upon the formulation. By purchasing the two liquids and suitable molds, manufacturers can form foam to their own specific needs. No external pressure or heat is required.

For stiffer plastisols

Triethyleneglycol dimethacrylate SR-205, produced by Specialty Resins, Inc., 842 N. Wells St., Chicago, Ill., is recommended by the manufacturer as an alternative for tetra-ethylene glycol dimethacrylate for increasing stiffness and rigidity of plastisols. Applications are toys, gaskets, etc.

Exchangers for analysis

Recognizing the growing use of ion exchange resins in chromatographic analysis, Rohm & Haas Co., Philadelphia, Pa., announces the introduction of its CG exchanger series especially designed for that application.

The CG series resins are chemically identical to R & H's standard and analytical grade Amberlite exchangers, but their particle size is more closely controlled during manufacture for greater uniformity. Two types are available. Type I, with a particle size between 100 to 200 mesh, separates materials with appreciably different chemical properties by a combination of ion exchange and adsorption. Type II

The Plastiscope

has a particle size that passes 200 mesh (dry), offers greater rate of reaction, and permits sharp separation of closely related chemicals.

Prices are $9.50 per lb. for less than 25-lb. quantities (available from Fisher Scientific Co.); $7.50 per lb. in quantities over 25 lb. (directly from Rohm & Haas). Applications include analysis of amino acids, halogens, fatty acids, peptides, and others.

Luster restorer

Weather-dulled reinforced plastics panels, it is reported, can have most of their original luster restored by applying Resolac lacquer. Resolac, composed of acrylic resins in an organic solvent, is produced by Resolite Corp., Zelienpole, Pa. It can also be used to deepen the color, reducing light and heat transmission.

Consultants elect

Officers have been re-elected for one year by Association of Consulting Chemists and Chemical Engineers, Inc. as follows: president—Carl Bussow, A. W. Dow, Inc.; vice president—Foster Dee Snell, Foster D. Snell, Inc.; secretary—Earl D. Stewart, Schwarz Labs., Inc.; treasurer—William C. Bowden, Ledoux & Co., Inc.

Plastic heel bases

Polyethylene heel bases are now being injection molded at the Windsor, Vt., plant of The Goodyear Tire & Rubber Co., Inc. Full production is expected some time early next year on a complete line of polyethylene heel bases for men's, children's, and some women's shoes.

Fluorocarbon-silicone rubber

Combining the ease of fabrication of silicone rubber with the solvent resistance of fluorocarbon plastics, a new heat-resistant rubber which does not swell on contact with aircraft fuels and oils has been announced by Dow Corning Corp., Midland, Mich. The new rubber was developed in collaboration with the Materials Laboratory of the Wright Air Development Center of the Air Research and Development Command.

Known as Silastic LS-53, the new fluoro-silicone rubber will be limited for the present to essential aircraft applications. Its properties are most needed in O-rings and other seals where the rubber must perform over a temperature range from −80 to over 400° F. and still resist swelling and attack by gasoline, jet engine fuels, hydraulic fluids, and engine oils.

Adhesive film

Pressure-sensitive transfer film for instant adhesion has been developed by Angier Adhesives, Div. of Interchemical Corp., Cambridge, Mass. Designated Double-Face, the new adhesive medium is suggested as a substitute for liquid adhesives and mechanical fastenings.

The film, which is pliable, incorporates a special tissue reinforcement. It is said to be adaptable to a variety of porous and non-porous materials and to conform with ease to highly irregular surfaces. The material is supported by a double-coated release paper which can be removed at once for instant bonding or at a later date by the consumer. It can be slit or die cut with protective release paper in place. According to the manufacturer, Double-Face speeds production, reduces waste, and eliminates the need for drying and coating equipment.

Polyurethane foam in electronics

A series of lightweight flexible polyurethane foam sheet broadband microwave absorbers are now available from Emerson & Cuming, Inc., 869 Washington St., Canton, Mass. Designated Eccosorb AN, it is used for lining antenna nacelles and enclosures. The material is said to be readily cemented to or draped over items which produce undesired reflections. Reflectivity is less than 2% of incident energy.

Eccosorb AN is white surfaced for good light reflection and is useful from −94 to 300° F. Eccosorb AN 75 covers all microwave bands from S through K. Eccosorb AN 73 covers X through K bands. It is ⅜ in. thick and weighs less than 2 oz./sq. foot.

Impregnant fireproofs

Paper can be made fireproof by impregnating it with Synco 85, a new resin developed by Synco Resins, Inc., Bethel, Conn. The company states that the only effect on continued exposure to direct flame is charring at the point of contact; there is no "after glow" or "punking." The papers also are said to show the increased strength and chemical resistance characteristic of phenolic-impregnated materials. Good resistance to water immersion or outdoor exposure is obtained by a light size coat. Paper so impregnated is expected to find application in air filters, insulation, honeycomb cores, overlays, and laminates.

Synco also announces the opening of a new laboratory which will triple its research facilities.

"Organic" silanes

Four new silicon chemical intermediates, designated Organo-Functional silanes, are available from Silicones Div., Union Carbide and Carbon Corp. Until now, silicones have been inert and have been useful in fields where this inertness and other unusual properties were of value. These silanes, on the other hand, can be reacted *with* organic chemicals *as* organic chemicals. Key to this organic reactivity is the addition of functional groups to conventional organosilanes.

The company feels that from work already done in the field of OrganoFunctional silanes, they can be useful in the modification of ingredients of emulsifiers, anti-static agents, sizing and finishing agents, synthetic resins, and others. For example, glass

The Plastiscope

cloth finished with *gamma*-aminopropyltriethoxysilane, one of the four "organic" silanes offered by Union Carbide, is said to give superior glass cloth laminates with melamine, phenolic, and epoxy resin systems. Organo-Functional silanes have also been chemically incorporated with polyamide, polyurethane, and epoxy resin systems.

Adhesives for laminating

Three new adhesives for laminating have been developed by National Adhesives Div., National Starch Products, Inc., 270 Madison Ave., New York, N. Y. They are: rubber-based Resyn 36-6254 for laminating cellulose acetate butyrate to foil in the production of metallic yarn; vinyl lacquer Resyn 76-3930 for laminating reverse printed cellulose acetate to foil used in "boilable" flexible containers; and Resyn 76-3944 for laminating Mylar to metallized Mylar or Mylar to foil.

All three adhesives may be applied by reverse roll or gravure methods.

Latest dinnerware maker

Entry into the plastics field with the introduction of a new line of melamine dinnerware has been announced by Stetson China Co., Merchandise Mart, Chicago, Ill., manufacturer of pottery dinnerware. The dinnerware will be molded at the company's Manitowac, Wis., plant, using American Cyanamid Co.'s Melmac melamine.

The company also plans to mold household goods other than dinnerware.

Teflon tape

Availability of close-tolerance Teflon tape has been announced by Tri-Point Manufacturing, Inc., 401 Grand St., Brooklyn, N. Y. The tape is finding use in the electronics, aircraft, chemical, and equipment industries as high-frequency, high-temperature insulation, chemical gasketing, and as an exceptional "abhesive" and slip surface.

Fifteen gages from 0.002 to 0.125 in. are offered. Tolerance on gage ranges from ±0.0005 in. on thin stock to ±0.002 in. on thicker gages. The tape can be specified from stock in widths ranging from ½ (suitable for braiding) to 12 in. (wrapping and lining). All gages and dimensions of tape are supplied wound on standard 1½- and 3-in. I.D. cores.

Tri-Point recently announced the development of equipment for the precision extrusion of Teflon rods. (See MODERN PLASTICS 33, 272, November 1956.)

Glass fabrics up

Price increases ranging from 1 to 5¢ a yd. on most of its glass fabrics for industrial end use has been announced by Hess, Goldsmith & Co., Inc.

Campco licenses Italian firm

Under a recently completed licensing arrangement with Chicago Molded Products Corp., Pirelli S.p.A., will manufacture Campco styrene-alloy sheet in Milan, Italy. The agreement between Pirelli and Chicago Molded includes an interchange of technical information on sheet extrusion methods, processes, and machinery, as well as training in this country of Italian representatives in Campco manufacturing methods.

Foam process for license

A process to manufacture foam plastics which permits compression molding or extrusion of foam plastics with communicating pores has been introduced in the United States and Canada by Dr. Werner H. Kreidl, 57 W. 58th St., New York, N. Y., from whom licensing information can be obtained. Polyvinyl chloride, polyethylene, and phenol-formaldehyde are among those resins which can be handled by the Kreidl process.

Applications for the foam are reported to be in the manufacture of filters for the chemical and food industries, for air filters, for diaphragms for the chemical and electrochemical industries, and as soundproofing material.

By use of the process, it is further stated, pore volume and pore diameter can be precisely predetermined.

Vinyl for fire protection

Protection against the hazards of fire in industry and water in agriculture, which began to show a good potential in 1955, this year is becoming an increasingly important use for vinyl film, according to C. O. DeLong, president of B. F. Goodrich Industrial Products Co., Akron, Ohio.

Mr. DeLong states that in its first 18 months of use as a fire-retardant barrier, millions of square feet of Koroseal flexible material have gone into industrial roof construction. The material, used as a vapor barrier between roof deck and insulation, prevents drippage of inflammable asphalt or tar which can add to the seriousness of industrial fires. The Koroseal roof-vapor-barrier construction, developed by Lexsuco, Inc., Cleveland, Ohio, has been proved by Factory Mutual tests as fire retardant with a Class 1 rating.

In addition to use in industrial applications, the vinyl film holds promise of new fire safety for schools, public and private buildings, and flat-top homes.

Training in Shaw process

Pilot foundry and laboratory facilities have been established at Port Washington, N. Y., by Shaw Development Corp., a subsidiary of British Industries Corp., for the purpose of licensing American foundries and training personnel of Shaw Process licensees in the application of Shaw's new method of making precision castings.

The Shaw Process produces a precision investment casting for all castable ferrous and nonferrous metals, similar in accuracy and finish to a "lost wax casting" but up to ½ ton and larger in size, from simple refractory molds utilizing low-cost

The Plastiscope

patterns and equipment. Applications include plastic molds and extrusion dies.

Treated Teflon insulation

Wire insulated with specially treated printable Teflon has been developed by Tensolite Insulated Wire Co., 198 Main St., Tarrytown, N. Y. The treatment makes anti-hesive Teflon receptive to standard adhesives and printing foils without materially affecting the other desirable physical and electrical properties of the insulation. The company recommends the wire for leads on potted components.

Drum liners

Commercial production of Stripak drum liners for hot melt and tacky materials has been announced by Food Film, Inc., Clinton Rd., Caldwell, N. J. The liners, made of polyvinyl alcohol, are claimed to handle adhesive and cohesive material which normally are very difficult to remove from the drum; i.e., polyisobutylene, polyvinyl ether, various hot melts, and rubber compounds.

The liners are preferably placed by air pressure. Molten materials at temperatures up to 400° F. can be poured into the liner. According to the company, the cost of the film is more than compensated for by savings in drums and labor.

Thickening agent

Thixotropic body is imparted to polar, non-polar aromatic, and aliphatic solvents, as well as to non-solvent-containing liquid resins and plasticizers, by Viscotrol A, a thickening agent produced by Ferro Corp., 4150 E. 56th St., Cleveland, Ohio.

Advantages claimed by Ferro for Viscotrol A over other thickeners are 1) that its ability to body organic liquids is not affected by phenols, polar solvents, water, and slightly acidic or basic components; 2) that it will maintain uniform viscosity over long periods of aging. It does not affect the rate of drying, scratch resistance, adhesion, color, gloss, or other properties attributed to good finishes.

Glass-reinforced Teflon

Woven glass fabric coated with Teflon is now available from Shamban Engineering Co., Culver City, Calif., or its affiliate, W. S. Shamban & Co. of Indiana, Ft. Wayne, Ind. According to the company, the material's flow under combined heat and pressure is very low. It remains pliable at temperatures below —100° F. and inert up to 390° F. The material does not crack when creased under moderate pressure.

Applications include conveyor belts for use in food, candy, and other industries where sanitation and ease of release are important; non-sticking covers for heat-sealing bars on packaging equipment, hand-sealing irons, and sealing plates; re-usable fabric separator release sheets in laminating operations; and others.

The material is available in various standard single ply constructions or multiple ply laminates in all standard sizes and may be Bondized one side only for adhesion to a variety of materials.

Vinyl in geophysical year

Molded high-impact Boltaron vinyl copolymer has been chosen for leg bands in the first distribution study of the South Pole skua, a gull-like bird inhabiting the South Pole region and first seen by Amundsen in 1910. The project, which is planned in conjunction with International Geophysical Year, includes nine countries with 21 banding stations at different locations in the Antarctic. A different color combination of Boltaron will be used for leg bands at each station to facilitate the study of the birds and their flight habits.

Vinyl copolymer was selected because it is light in weight and can be readily molded with integral colors into leg bands that are easily applied by snapping around the bird's legs.

Prepreg line expanded

Preimpregnated glass mat and woven roving are now available from Cordo Molding Products, Inc., 230 Park Ave., New York, N. Y., in epoxy, stabilized polyester, and phenolic resins. This type of mat and roving offers advantage to the molder in that it eliminates the compounding operation and permits him to process the material through conventional die cutting and blanking for the correct charge. Seven- to 10-fold increases in production over conventional wet lay-up processes are claimed to result.

Cordo makes 16 different types of preimpregnated fabric and molding compounds.

Cleaner for windshields

A new cleaner and polisher that improves pilot vision by removing fine scratches and haze from plastic windshields on aircraft and boats has been developed by Schwartz Chemical Co., Inc., 326 W. 70th St., New York, N. Y.

Designated Acrakleen, the product is said to be effective on all kinds of plastics, including acrylics, polystyrene, acetate, and rigid and flexible vinyls.

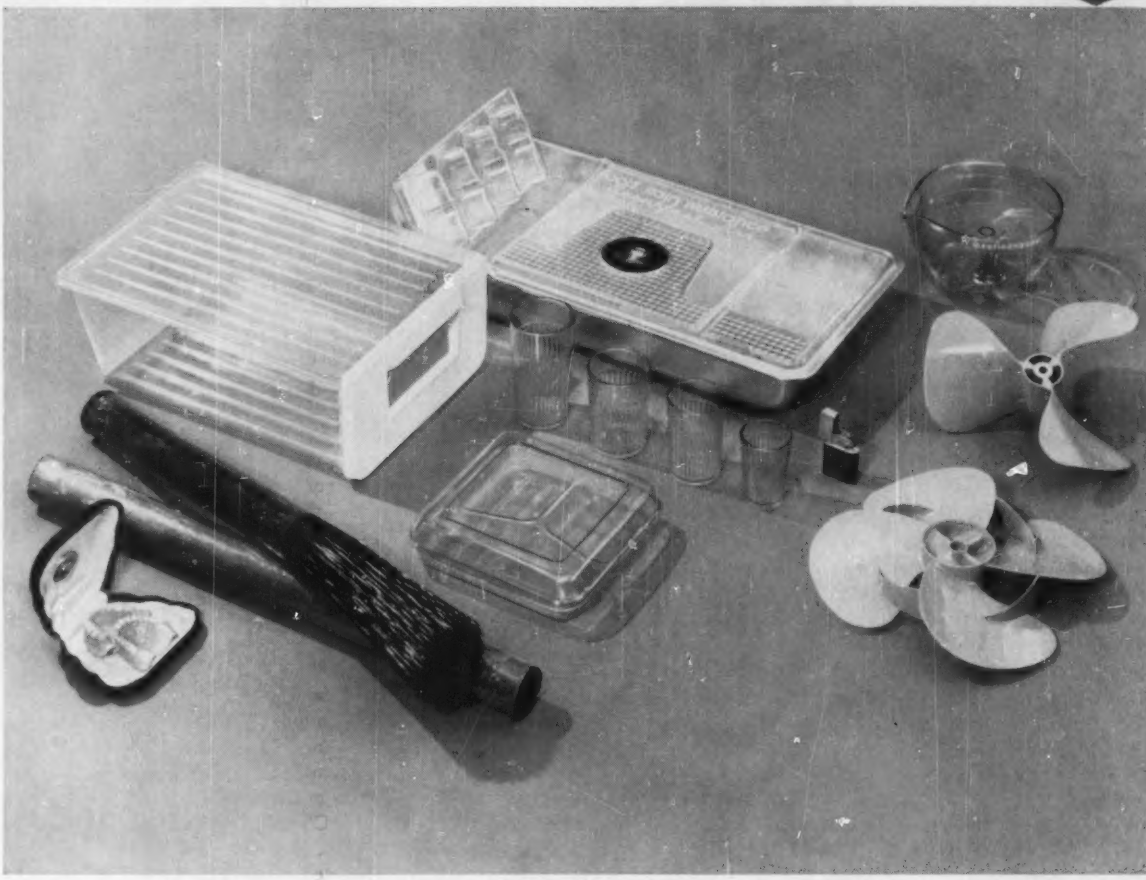
Pressure-sensitive Teflon tape

Now available from Enflo Corp., Pennsauken, N. J., is pressure-sensitive cementable Teflon tape in thicknesses from 0.0005 to 0.60 in., ½ to 12 in. wide. One surface of the tape is treated by a special process, which makes the Teflon readily bondable to plastics, glass, steel, aluminum, etc.

Polyvinyl ether resins provide an aggressive tack. Using the 1-in. standard peel back test, the tape will average 3 to 8 lb. per linear in., depending upon the cleanliness, absorption, and roughness of the mating surface.

Enters supported vinyl field

Production has been started by Scranton Lace Co., Scranton, Pa., on a line of plain, printed, and embossed vinyl sheet laminated to drills, twills, cotton knits,



Now and in the years to come, more and more products will become possible and practical with Styrex 767.

STYREX 767 opens new horizons for the plastics industry...*here's how*—

Here's real news! Styrex® 767, with superior crazing resistance, lends itself to applications previously considered impossible with thermoplastic materials. Plans heretofore unworkable can now be dusted off and brought to reality!

There are many reasons designers will want to start working with Styrex 767 right away—

An improved copolymer of styrene acrylonitrile, Styrex 767 is a rigid thermoplastic that is readily molded or extruded. It also has an excellent balance of physical properties. A high degree of toughness and heat resistance are combined with superb stress strength. It is resistant to acids, bases, salts, oils, waxes, soaps, food stains, and many solvents including gasoline and kerosene. Styrex 767 can be readily machined and decorative coatings are practical. It is available in natural color as well as transparent and opaque. Styrex 767 provides a new high standard of transparency in sparkling clear-toned colors. And Styrex 767 is already in full scale production, assuring availability of the product when you want it.

No matter what plastics you are using, you'll want to test this important contribution to the advancement of the industry—

Styrex 767 is the first of a family of new Dow plastics based on styrene acrylonitrile. Phone, wire or write for complete technical and application information. You'll find means to enlarge your markets, extend your fields of operation.

Dow Technical Service, with its extensive experience, is ready to help you. THE DOW CHEMICAL COMPANY, Midland, Michigan—Plastics Sales Department PL 430B.

you can depend on DOW PLASTICS

The Plastiscope

sheeting, nylon backing cloths, and other fabrics. This is the company's first venture into the field of vinyl-cloth laminations.

The material is being offered in widths up to 72 in., some of it in three-layer lamination, with the supporting fabric sandwiched between sheets of vinyl. Applications include luggage, beach umbrellas, tarpaulins, outdoor furniture, baby carriages, etc.

Permanent adhesive

Contact adhesive C-9199, an elastomeric compound of modified neoprene base, is being offered by Pierce & Stevens Chemical Corp., 710 Ohio St., Buffalo, N. Y., for permanent bonding of decorative laminates, honeycomb paper, metals, wood, etc. Bonding is completed instantaneously by pressing the adhesive-coated surfaces into contact with each other.

Bonds made with C-9199 are claimed to be odorless; non-staining; and resistant to heat, moisture, oil, grease, and many chemicals.

Epoxy news

Considerable activity has been taking place in the field of epoxy processing and applications over the past month. The latest developments are summarized below:

Hardeners and release agents. Several products have been introduced by Smooth-On Mfg. Co., 572 Communipaw Ave., Jersey City, N. J., for use with epoxy resins: A low-viscosity curing agent, Sonite No. 41, for use in glass-reinforced epoxy laminates is said to combine readily with liquid epoxy resins at room temperature and to provide high heat distortion temperature, toughness, and flexibility. The uncured resin mixture has a pot life of 8 hr. (½ lb. at room temperature). Sonite No. 41 is available in quarts, gallons, and 5-gal. containers.

The company also offers low-viscosity hardener Sonite No. 23 specifically designed for use with Sonite X1 epoxy resin casting compound used in potting and encapsulation. The hardener is claimed to impart flame, mechanical, and thermal shock resistance to the final component. Sonite No. 23 cures at 250° F. in 2 hours.

For parting of epoxy resin castings from plaster molds, or from metal, wood, or epoxy masters, Sonite Seal-Release is said to seal surface pores to exclude even water vapors. It can be applied by rubbing, brushing, or spraying.

Flexible epoxy casting resin. Controlled flexibility in the finished product is claimed possible through the use of Stycast 2741, a new two-component epoxide casting resin produced by Emerson & Cuming, Inc., 869 Washington St., Canton, Mass. The material cures at room temperature, but cure can be accelerated by use of elevated temperatures.

According to the company, Stycast 2741 retains flexibility at −70° F. and is, therefore, recommended for encapsulating, potting, and sealing applications requiring low-temperature use. It can also be used at +300° F. without harmful effects. Shrinkage during cure is negligible; adhesion to most materials is excellent.

Compounds for encapsulation. Transparent, flexible, and foam encapsulating compounds for industrial and commercial applications are now available from Telectro Industries Corp., 35-18 Thirty-seventh St., Long Island City, N. Y.

The transparent compound sets in 15 minutes at a temperature of 180° F., is inexpensive, consists of only two components, and is easily released from the molds. The flexible compound is an epoxy formulation which features variable flexibility and is said to be less expensive than other epoxy formulations. Large castings of 7 to 8 lb. can be cured at room temperatures, effecting savings in operating and curing costs. The foam compounds are available in various densities and require low temperatures up to 150° F. for curing.

Telectro will supply these compounds in any quantity or will encapsulate companies' products at a reasonably low price.

Furane epoxies. Filled epoxy resin Epocast 11-C has been developed by Furane Plastics, Inc., 4516 Brazil St., Los Angeles, Calif., to serve as a shield against harmful radiation originating from nuclear reactors. High in density, its mass is claimed to arrest alpha and beta radiation, and offer substantial resistance to gamma radiation, depending upon total thickness.

Epocast 11-C may be cast as rectangular blocks and into more complicated shapes, such as shields about valve bodies, pipe fittings, etc. The cast material will set rapidly at room temperature, forming a hard, stable mass.

Epoxy resins are now available with safety hardeners which are said to be non-dermatitic and resistant to high humidities, according to Furane. The properties are expected to result in expanded epoxy paste usages in the marine fields, automotive industries, concrete and clay pipe industries, and chemical process industries.

The pastes being offered include steel-filled Epocast 154, aluminum-filled Epocast 152, and mineral-filled Epocast 150. These epoxy pastes will cure completely at room temperature upon the addition of the safety hardener.

Reichhold now in epoxy. Devoe & Raynolds Co., Inc. has granted to Reichhold Chemicals, Inc. a non-exclusive epoxy resin patent license for the United States and Canada, and the latter firm will now enter the epoxy resin field.

Epoxide foam. For use in potting, void filling, insulation, and buoyancy applications, Eccofoam PT, produced by Emerson & Cuming, Inc., Canton, Mass., is said to result in uniform foams.

Supplied as two components which are mixed together, the material resembles foundry molding sand prior to use. It is packed

FEWER REJECTS—HIGHER RESIDUAL STRENGTH PROVED

... in production run of Vacuum Formed Door Liners with

MONSANTO LUSTREX *Styrene Plastic*

Here is a doubly critical operation of sheet extrusion and final vacuum forming of impact-proof refrigerator door liners. Quality requirements for these finished liners are high! The raw material must extrude sheets that are easily vacuum formed into complex die shapes. At the same time, cycles must be rapid. The refrigeration end use requirement demands an odor-free styrene. But most important, high vacuum forming temperatures cannot affect basic strength of the finished door liners! These are rigid specs for any material.

In a recent run of 7,350 liners, Lustrex Hi-Test 88B met and exceeded these requirements. Paul Schmidt, Chief Thermoplastic Engineer of the Panelyte Division of St. Regis Paper Co., reports, "Working with extremely complex dies, sheets extruded from Lustrex Hi-Test 88B give us excellent resilience and constant flow regardless of high heat cycles ranging from 350°-500°F. In addition, resultant strength characteristics are maintained at a steady peak level." The finished vacuum formed Lustrex liners also pass the "slam door test"—an over-loaded door slammed shut thousands of times to simulate years of actual use. Performance like this cuts rejects at the assembly level to a fine minimum ... proof again of Lustrex performance and economy.

Investigate the moldability, strength and economies of Lustrex Hi-Test 88B for your next difficult requirement. Write for complete technical data to Monsanto Chemical Company, Plastics Division, Room 671, Springfield, Mass.

LUSTREX HI-TEST 88-B

MONSANTO

The Plastiscope

or tamped into place in the cavity to be filled. Cure is effected at room or elevated temperature.

Cured Eccofoam PT is usable to 350° F. Density is less than 20 lb./cu. ft.; flexural strength is 800 p.s.i. It is of low dielectric constant and low dissipation factor.

Epoxy-tar protective coatings for use in general maintenance, equipment exteriors, tank linings, and floors have been introduced by Carboline Co., 331 Thornton Ave., St. Louis, Mo., under the name of Carbomastic. Solids content ranges from 85 to 90%, and application in thicknesses up to 10 mils per coat is said to be possible.

Correction

The density range of a continuously produced urea foam was reported incorrectly as 2½ to 4 lb./cu. ft. in "Equipment for urea resins and foam" (MODERN PLASTICS 34, 312, October 1956). The correct density range is from ½ to 1½ lb./cu. foot.

Plasticizer news

Harwick price increase. The price for several of its Polycizers plasticizers has been advanced ½¢ a lb. by Harwick Standard Chemical Co., Akron, Ohio. The new tank-car quantity price schedule is as follows: 162 (odorless DOP), 28.5¢ lb.; 562 (octyl decyl phthalate), 29¢ a lb.; 662 (didecyl phthalate), 29.5¢ a lb.; and 662A (electrical grade of 662), 29.5¢ a pound.

Pipe notes

Improved compound. Pipetite-Stik, a pipe joint manufactured by Lake Chemical Co., 3052 W. Carroll Ave., Chicago, Ill., is now rated at 750° F. maximum temperature and pressures to 5000 p.s.i. According to the company, Pipetite-Stik can be used on plastic as well as metal threads, on lines carrying water, steam, gas, refrigerants, oxygen, gasoline, butane, propane, brine, etc.

Pipe and fittings prices cut. Prices have been reduced by as much as 15% on all types of unplasticized PVC pipe and fittings offered by the Alloy Tube Div., The Carpenter Steel Co., Union, N. J. Covered in the price reduction are the company's high corrosion and high-impact types.

The changes apply to all schedules, including PR-150 with plain ends, Schedule 40 with plain ends, Schedule 80 with plain and threaded ends, and Schedule 120 with plain and threaded ends. Sizes in these schedules range from ¼ to 6 in. nominal pipe size.

Expansion

Du Pont's Film Dept. plans substantial expansion of manufacturing capacity for Mylar polyester film. This expansion is to be provided through new construction at the company's Circleville, Ohio, plant which will increase productive capacity by approximately 50 percent. The project is scheduled for completion early in 1958. The Circleville plant started operations in July 1954.

The Borden Co. plans to build a West Coast pentaerythritol plant with a production capacity of 10 million lb. a year, plus additional facilities capable of producing up to 40 million lb. of formaldehyde annually. The proposed plant, featuring integrated pentaerythritol-formaldehyde production, will be in Dominguez, Los Angeles County, Calif., site of Borden's present synthetic resin and emulsion polymer plant.

Up to now, the company has not been producing "penta," a chemical extensively used in paint resin manufacture. The product integrates with Borden's formaldehyde business. The proposed new formaldehyde production would increase Borden's present capacity by more than 20 percent. The company currently has a total of five formaldehyde plants located throughout the United States.

For formaldehyde production, Borden plans to use the new high-yield Karl Fischer process, for which the company has exclusive United States sublicense rights.

Celanese Corp. of America has started construction of a new polyol production unit at its Chemcel plant in Bishop, Texas, to meet the increasing demand for trimethylolpropane. The material is used in the production of polyurethane.

The new commercial unit is expected to be completed and in production by the last quarter of 1957. In addition to providing trimethylolpropane and other intermediates for polyurethane synthesis, it will produce a range of other products that will go into the manufacture of resins, brake fluids, and other expanding industrial fields.

Bassons Industries will establish a 35,000-sq. ft. branch plant at Nacogdoches, Texas, for the manufacture of plastics- (including Teflon-) insulated wire and cable products for construction, communications, aircraft missiles, and oil exploration; plastic pipe for irrigation and oil and chemical transmission in sizes of ½ to 6 in. in diameter; and reinforced plastic aircraft parts and subassemblies for the major air frame producers.

Operations at the new facility are expected to start early next year with an initial complement of 300 employees.

Penn-Plastics Corp. and its subsidiary, **Penn-Plastics Mfg. Co.**, have broken ground for a new addition to their plant in Glenside, Pa. The added wing will be used to house Penn-Plastics' injection molding facilities and for enlarging the Finishing Dept. The space freed by moving these operations to the new area will allow for the installation of additional compression and transfer


WITCO
CONTINENTAL BLACKS
ULTRA Chemical WORKS
PIONEER Highest Quality ASPHALTS
Emulsol
PLASTIC CHEMICALS
EXTENDER PIGMENTS
SURFACE ACTIVE AGENTS
DETERGENTS
CARBON BLACKS
RUBBER CHEMICALS
STEARATES
DRIERS
EMULSIFIERS

The Plastiscope

molding machinery. The company produces thermosetting and thermoplastics components for a wide variety of industrial fields.

Penn-Plastics also announces the election of **Charles W. Kleiderer** as executive vice president of both firms.

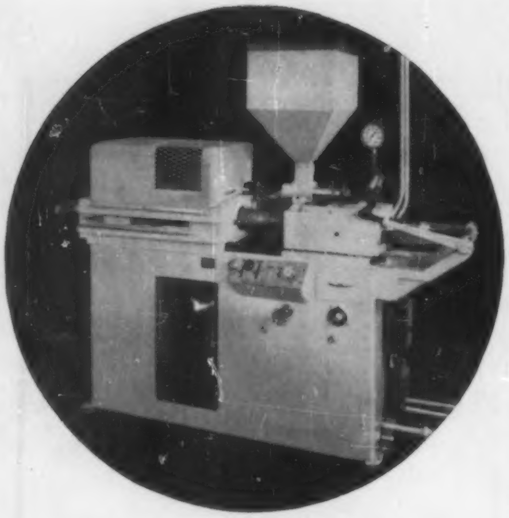
The Richardson Co. has broken ground adjacent to its executive and administrative offices in Melrose Park, Ill., for the construction of a new $500,000 research and development laboratory. The new unit, which is expected to be ready for occupancy in July 1957, will provide 15,000 sq. ft. of floor space that will be connected to the present laboratory building.

The company, which will reach its 100th anniversary in 1958, manufactures industrial laminate sheets, tubes, and rods, decorative laminates, and a varied line of thermoplastic and thermoset molded products.

British Hydrocarbon Chemicals, Ltd., jointly owned by **The Distillers Co., Ltd.** and **British Petroleum Co., Ltd.**, has authorized the design and construction at Grangemouth, Scotland, of a 25,000 lb. per year polyethylene plant using **Phillips Petroleum Co.**'s new catalytic process for making polyethylene and other polyolefin plastics.

Ferro Corp., Cleveland, Ohio, has purchased **Patterson Foundry & Machine Co.**, East Liverpool, Ohio, manufacturer of processing machinery for the plastics and chemical industries. With the purchase, Ferro, which makes colorants, stabilizers, and fibrous glass for the plastics industry, now enters the processing phase of the field.

Ohio-Apex Div., Food Machinery & Chemical Corp., has completed construction of its new office and warehouse facilities at 2121 Yates Ave., Los Angeles, Calif. The new location will include a tank farm with ample storage fa-



COME SEE US
OR WRITE US
on our newest development
of the

STANDARD AUTOMOLDER® PIERWOOD

CYCLES
less than 4 seconds
Fully Automatic

STANDARD TOOL CO.
213 HAMILTON ST., LEOMINSTER, MASS.

Outfitters to Plastics Mfrs. Since 1911

OMNI PRODUCTS CORP., Export Distributors, New York, N.Y.

Specialists in Molds for the Plastics Industry
ENGINEERING and DESIGN • INJECTION MOLDS
COMPRESSION MOLDS • DIE CASTING DIES
BERYLLIUM CAST CAVITIES
Manufacturers of
Fabricating Machinery for Plastics

AUTO-LITE

TEMPERATURE INDICATION...

- Precision-built indicators provide accurate temperature readings.
- Wide selection of dial ranges to meet specific requirements.
- Choice of mountings for specific needs.
- Send for new catalog, describing many styles of Auto-Lite Indicating and Recording Thermometers.

THE ELECTRIC AUTO-LITE COMPANY
INSTRUMENT AND GAUGE DIVISION
TOLEDO 1, OHIO
NEW YORK • CHICAGO • SARNIA, ONTARIO

TEMPERATURE INDICATORS & RECORDERS

110 Cities and Towns with Industrial Corporations to serve you in

MISSOURI

110 communities with capital totaling $15,180,000 are eager to help you find the best site for your plant, build to your specifications, and lease to you on long favorable terms, under Missouri's unique "Tailor Made" plan.

Locations are available in every part of Missouri. Here you'll have the advantage of a central shipping location, abundant raw materials from farm, mine and forest, plentiful water . . . and a large pool of trained workers with an excellent labor relations record.

Let us show you Missouri on your own private conducted tour. For complete, confidential information . . .

PHONE COLLECT
JEFFERSON CITY 6-7185
Richard Kinne, Industrial Director
Missouri Division of Resources & Development
Dept. L693, Jefferson City, Missouri

The Plastiscope

cilities for Ohio-Apex plasticizers and a modern warehouse building with an area of 10,000 sq. feet. Formerly, the offices were located at 306 W. Avenue, Los Angeles. **Glenn A. Farno** will be in charge of the new operation.

Ohio-Apex makes plasticizers; reactive monomers; Dapon, a prepolymer of diallyl phthalate resin; and other chemicals.

Kordite Div., Textron, Inc., has opened a new 175,000-sq. ft. plant in Jacksonville, Ill., for the manufacture of polyethylene film products, including dry-cleaning bags and printed and plain produce bags. Kordite has executive and manufacturing offices in New York. The company merged with Textron in 1955.

Molded Fiber Glass Boat Co. has started construction of a new building and equipment in Union City, Pa., for the production of reinforced plastic boat hulls. The hulls at present are produced in Ashtabula, Ohio, and shipped to Union City for finishing. The first preform machines and press are expected to be in operation in the new plant by the first of 1957. Until that time, the hulls will continue to be made in Ashtabula.

Columbian Carbon Co. has opened its third plant for manufacturing colloidal dispersions of carbon black. The new plant is located in Tacony (Philadelphia), Pa.; the others are in Easton, Pa., and Toronto, Canada.

Included in the Columbian line are colloidal dispersions of carbon black in nitrocellulose, ethyl cellulose, and cellulose acetate; vinyl, styrene, alkyd, acrylic, and hydrocarbon resins; and chlorinated paraffins and water.

Tri-Point Mfg. & Developing Co., 401 Grand St., Brooklyn, N. Y., has started construction of a new 14,000-sq. ft. building in Albertson, N. Y., to house its general offices and production facilities. The new structure, which is ex-

The Plastiscope

pected to be completed by the end of this year, will allow the company to increase its productive capacity as well as to enlarge its plastics research and development laboratory. The counterpart of the latter facility in the Brooklyn plant was responsible for the development of a radically improved extruder for Teflon fluorocarbon rod.

Quelcor of Cincinnati, Inc., 1050 Hulbert St., Cincinnati, Ohio, has been formed as a subsidiary of **Quelcor, Inc.**, Chester, Pa. The new organization will extend Quelcor's activities in the field of corrosion-resistant plastisols to meet customers' requirements in that area. The plant will specialize in rigid polyvinyl chloride fabrication, tank linings, dip coating, and molding of plastisol parts.

John Kozacik is president of the subsidiary and **Raymond Mueller** secretary-treasurer. Mr. Mueller is president of Ray Mueller & Associates and will handle the sales function.

Reiss Associates, Inc. has moved into its enlarged plant in Lowell. Mass. The plant, which occupies an area of over 104,000 sq. ft., is devoted to the production of Railite and Raiboard decorative melamine laminates.

Stillman Rubber Co. has completed an 8000-sq. ft. two-story office and warehouse building adjacent to the company's existing plant at 5811 Marilyn Ave., Culver City, Calif.

Midland Industries, Ltd., Midland, Ont., has acquired the **Plastics Div.** of **Percy Hermant Co.**, King St., E., Toronto, Ont., manufacturer of injection molded plastic products for over 20 years. No change in personnel is contemplated and the Toronto Div. will continue for the time being to operate at its present location as the **Hermant Plastics Div. of Midland Industries, Ltd.**

The Midland plant, which man-

ufactures polyethylene pipe, hose, and other extruded and injection molded products, will be expanded. Present plans call for the integration of both operations in a 40,000-sq. ft. building to be erected at Midland.

Herbert C. Lee is president of Midland Industries and **Archie Hyatt** executive vice president. **Percy Hermant** is president of the Hermant firm. **Frank Crombie,** formerly manager of Hermant, now manager of the new division; **Martin Kamins** is superintendent of the Engineering and Molding Depts. and **Stanley Manchester** product sales manager.

Meetings

Plastics groups

January 16-18, 1957: Society of Plastics Engineers, Inc., Thirteenth Annual National Technical Conference, Hotel Sheraton-Jefferson, St. Louis, Mo.

February 5-7: The Society of the Plastics Industry, Inc., Twelfth S.P.I. Reinforced Plastics Division Conference, Edgewater Beach Hotel, Chicago, Ill.

March 18-21: The Society of the Plastics Industry, Inc., S.P.I. Annual National Conference, Los Angeles-Biltmore Hotel, Los Angeles, Calif.

March 18-21: The Society of the Plastics Industry, Inc., Pacific Coast Plastics Exposition, Shrine Exposition Hall, Los Angeles, Calif.

Other meetings

December 27: The Gordon Research Conferences, Twenty-fifth Anniversary Dinner, Commodore Hotel, New York, N. Y. Reservations $10.00, by application to Dr. W. George Parks, University of Rhode Island, Kingston, R. I.

January 17-24, 1957: Independent Housewares Exhibit, Inc., Ninth National Independent Housewares and Home Accessories Exhibit, Morrison Hotel, Chicago, Ill.

February 4-6: National Combination Storm Window and Door Institute, Inc., First Home Improvement Products Show, Hotel Statler, New York, N. Y.

Companies . . . People

Injection Molding Co., Kansas City, Mo., is the subject of a feature article in that city's Chamber of Commerce publication which gives a history of the company's progress since it was started in 1946 with three injection molding machines by the president, **W. K. Archer.** The organization, which is claimed to be the largest volume producer of polyethylene bottles in the United States, now consists of the original division established on an 18-acre site, plus **Flexcel Container Corp., Imco Container Sales Corp.,** and **Excelsior Plastics Co.,** Excelsior Springs, Mo. Three hundred employees work around the clock six days a week, operating machines which couldn't be replaced for less than $5 million. Most of the containers are under patent by **Injection Molding Co.,** with licensees in France, England Brazil, Argentina, and Chile.

Escambia Chemical Corp.—Plastics Div.: James M. Martin, formerly with B. F. Goodrich Chemical Co. for the past 10 years, named New England sales representative. **William F. Christie,** former development director of Ross & Roberts Co., now sales representative for the Middle Atlantic states.

Cadillac Plastic & Chemical Co. has opened a branch at 3333 Detroit Ave., Cleveland, Ohio, with **Raymond Weber,** former assistant general manager of the Detroit home offices, as branch manager. This marks the second new branch and third expansion for the company within a few months; a Milwaukee branch was opened in July. Cadillac entered mass production of extruded acrylic sheets in September. Other branch openings are scheduled for early 1957, according to the company.

Atlas Powder Co. has acquired **Thermaflow Chemical Corp.,** Tunkhannock, Pa., which will operate as a subsidiary of Atlas. Thermaflow produces high-impact reinforced plastic molding compounds; Atlas produces polyester resins, a major ingredient of Thermaflow's compounds.

Edward J. Massaglia, general manager of operations at Atlas' Chemicals Div., elected president of the subsidiary; **Robert P. Barnett,** secretary; and **John B. Capella,** treasurer. **Richard F. Doyne** continues as sales manager of Thermaflow, with headquarters at Atlas general offices in Wilmington, Del. Mr. Capella also named plant manager, with headquarters at the plant in Tunkhannock.

The Rainville Co., Inc.: The Rainville Co. of California, 1420 S. Garfield Ave., Alhambra, Calif., has been formed, with **Arthur D. Rainville** as president. Mr. Rainville has been acting as a representative of the parent company since its inception four years ago. The firm specializes in the sale of machinery for the plastics industry. Rainville has also opened a Chicago office at 3105 N. Cicero Ave., with **Myron C. Borovik** as district manager. This office will sell a complete line of products for the plastics industry.

Ekco Products Co. has purchased the **Plasteel Div. of P. R. Mallory Plastics, Inc.,** Chicago, Ill., and has acquired the complete molds, dies, inventory, etc., of Mallory's line of plastic bathroom accessories. Ekco's new line of plastics housewares will be manufactured and distributed by its subsidiary, **The Autoyre Co.**

Mallory is abandoning operations in the bathroom accessory field in order to secure additional manufacturing space for its expanding line of molded plastics dinnerware and picnicware.

New Plastic Corp., Los Angeles, Calif., manufacturer of NUPLA surface protective hammers and NUPLA plastic wall tile has recently purchased **Lansco Die Casting Co.,** El Monte, Calif., as a wholly-owned subsidiary. Lansco specializes in engineering, design, tooling, and production of parts for the automotive, hardware, plastics, and allied industries. Lansco has a modern die making and die casting plant with more than 7000 sq. ft. under roof, plus 10,000 sq. ft. of property available for expansion.

Lansco's key personnel has been retained, with **William B. Lane** continuing to direct the company as president and general manager. **J. A. Carmien** is president of New Plastic.

Reichhold Chemicals, Inc.: Henry H. Reichhold elected president; **Charles J. O'Connor** named chairman of the board; **Albert G. Goetz** its vice chairman; **Donald B. Tuson,** comptroller, elected a member of the board.

Hercules Powder Co., Inc.: Cellulose Products Dept. established new sales office in the Continental Bldg., 3615 Olive St., St. Lou[illegible] Mo., under the direction of **Rob[illegible] R. Stover,** technical sales representative. The new office will service southern Illinois, Missouri, Kansas, Oklahoma, and Texas.

F. J. Stokes Corp.: George Karian, appointed manager of the Tabletting Div., will supervise all product design, sales, and customer service activities for the complete range of Stokes hydraulic and mechanical compacting presses for pharmaceutical, powder metal, ceramic, plastics preforming, and other industrial compacting applications.

Milton A. Sanders now on the field sales staff of Stokes' Plastics Molding Equipment Div. His former affiliations were with Bloomfield Molding Co. as general manager and Sun Tube Corp. as chief research engineer. Mr. Sanders is currently teaching plastics technology at the Newark College of Engineering under the SPE-sponsored educational program.

The Dow Chemical Co.: A. T. Massberg, with the company 20 years and technical director of plastics production for the past two years, appointed director of research and development for the

Companies . . . People

Midland Div. Arthur F. Roche, assistant director of the Plastics Production Laboratory, named to succeed Mr. Massberg.

Olin Mathieson Chemical Corp.: Arthur T. Safford, Jr. and **E. L. Lynn** named to newly created posts of assistant general managers of the **Film Div.** Mr. Safford was formerly sales manager; Mr. Lynn was formerly production manager.

Regal Plastic Co., Kansas City, Mo., has established a sales-engineering office in Detroit, Mich., with **H. H. Jones** and **H. M. Shields** as sales representatives. **R. F. Carlson, Jr.** named resident sales representative in St. Louis, Mo.

Daneel Associates, 1493 Main St., Hartford, Conn., appointed exclusive representative in New England and eastern New York for **Frank V. O'Neil Color Corp.**, Long Island City, N. Y. O'Neil produces a line of colorants for regular and high-impact styrene and polyethylene, both matched and standard.

Hellmich Mfg. Co. has moved its main office to 4417 Oleatha Ave., St. Louis 16, Mo.

Industrial Roofing & Sheet Metal, Inc., Cleveland, Ohio, has been named northern Ohio distributor for **Seilon DP**, a rigid polyvinyl chloride, produced by **Seiberling Rubber Co.**, Newcomerstown, Ohio, for glazing and fenestration purposes in building construction.

The Pantasote Co. has moved its New York offices from 444 to 415 Madison Ave.

Tele-Muff Co., San Fernando, Calif., has been acquired by **Z. S. Chapman**, sales manager, from **Stillman Rubber Co.**, Culver City, Calif. The transaction also includes another Stillman division, **Plasticast, Inc.** Tele-Muff Co. manufactures polyvinyl advertising specialties; Plasticast special-

izes in polyvinyl dipping and coating. Headquarters for both companies will remain at 1421 First St., San Fernando.

United States Rubber Co.—Royalite Plastic Products: The following sales engineers have been promoted: **William L. Moore** for New England and upper New York; **Joseph P. Clancy** for the Middle Atlantic states; **Donald F. Mirrielees** for northern Illinois, eastern Iowa, Wisconsin, and Minnesota; and **James H. McFarland** for the West Coast.

Marinform Corp., 260 Kearny St., San Francisco, Calif., has been organized to engage in extrusion-continuous-vacuum-forming, initially for the packaging and container fields.

President of the firm is **Franklin H. Gentes,** formerly with Dow's San Francisco office.

Doram Products, Inc., formerly at 410 Frelinghuysen Ave., Newark, N. J., has moved both factory and offices to larger quarters at 906 Lincoln Blvd., Middlesex, N. J. The firm makes varnishes and coatings for vacuum metallizing and silver spraying.

The move has enabled Doram to add a complete pilot plant under the name of **Irwin Industries** for the purpose of proving the various varnishes, coatings, and metallizing processes for customers' products.

Ace Plastic Molding Corp., 5-01 Forty-seventh Rd., Long Island City, N. Y., has been formed to specialize in custom injection molding. **Pete M. Miale** is president and **William B. Kerzner** vice president.

Michigan Chrome & Chemical Co.: Donald G. Patterson, transferred to the Chicago territory. **Ted Root** assigned to the Michigan territory. He has been working in the company's laboratory developing applications for Miccro coatings.

American Bio-Chemical Laboratory, Inc. has moved to larger quarters in the Science Center Bldg., 1113 N. Rolling Rd., Baltimore, Md. The laboratory's fa-

Companies . . . People

cilities include equipment for molding, for roller coating, and for testing plastics and plastic-coated boards. Studies in heat sealing and problems of lubrication are regularly conducted. **Dr. Samuel L. Goldheim** is director.

Shawinigan Resins Corp.: Southern district sales office opened at 1401 Peachtree St., N. E., Atlanta, Ga., under the direction of **W. F. Hill**, assistant district manager.

John Dale, Ltd., New Southgate, London, N.11, England, has acquired from **Flexipac, Ltd.** the rights to manufacture in Great Britain, Canada, and Switzerland plastic collapsible tubes under the processes patented in those countries by Flexipac.

The Baker Castor Oil Co.: James D. Wilson assigned to the sales service staff as head of the Plastics and Rubber Laboratories and **Louis E. Machado** to the commercial development staff as assisting chemist of the Quality Control Dept.

Thomas Mfg. Corp.: New York sales offices and show rooms opened at 200 Fifth Ave. **I. H. Bernhard**, active figure in the toy industry for over 70 years, named vice president of the company. **Frederic A. Bovais** now sales manager.

Fabrite Metals Corp., Pawtucket, R. I., metal finisher and distributor of laminating, polishing, and embossing press plates, has moved its general sales offices to 1547 Covert St., Brooklyn, N. Y.

Libbey-Owens-Ford Glass Co.: Richard W. Kazmaier, with the company since 1929, promoted to superintendent of the laminating plant at East Toledo, Ohio, succeeding **Albert W. Kleine**, who was recently promoted to production manager of the East Toledo laminating and plate glass plants. Mr. Kazmaier's former post of assistant plant superintendent at the laminating plant will not be filled as such, but the general supervisory functions will be divided among the three shift superintendents — **William Akos, Richard Myrice, and Irving Willey.**

Southern Plastics Co.: D. W. Weber now chief engineer and mechanical superintendent and **E. M. Staub** superintendent of the Extrusion Dept. Both appointees have been with the company for 11 years.

W. A. Hart, St. Charles, Ill., has established a mold design service for Midwest molders and mold building shops. With 20 years' experience in the plastics industry, Mr. Hart has a complete knowledge of all types of molds, the problems of production and finishing, the need for standardization, and good mold construction.

Robert B. Wilbur, formerly manufacturers sales representative for the eastern division, promoted to

sales manager for polyurethane products of **The General Tire & Rubber Co.** Mr. Wilbur will report to **John O'Grady**, manager of General's Marion, Ind., plant operations.

Richard W. KixMiller, vice president in charge of the Chemical Div. of **Celanese Corp. of America**, named a director to succeed **Charles F. Beran** who has retired.

Sam Gurley elected vice president of sales of **H. K. Porter Co., Inc.** His former affiliations were with Reichhold Chemicals, Inc., The Borden Co.'s Chemical Div., and Barrett Div., Allied Chemical & Dye Corp.

Du Pont: William L. McIntosh appointed New York assistant district sales manager of the Film Dept. **John A. Pie** now Chicago assistant district sales manager.

Burton V. Coplan, with the company since 1948, now silicon project supervisor of **General Electric Co.'s** Chemical Development Dept., Pittsfield, Mass.

Package Designers Council has opened new executive offices at 271 Madison Ave., New York, N. Y., with **Glenn Mather** as executive secretary.

Carl J. Luz now an assistant department head in the Vinyl and Polyethylene Fabrication Dept. at **Bakelite Co.'s** Bound Brook, N. J., plant. Mr. Luz came to the company in 1951 and has worked with the thermoplastic Quality Control group.

A. David Evans, formerly manager of resin materials sales, now St. Louis district sales manager of **Monsanto Chemical Co.'s Organic Chemicals Div.**, St. Louis, Mo. He succeeds **B. Baxter Pearson** who died in October.

Clifford W. Brown, formerly vice president and general manager of **Narmco Resins & Coatings Co.**, an affiliate of **Narmco, Inc.**, Costa

Companies . . . People

Mesa, Calif., now president. The company manufactures structural adhesives, fibrous glass laminating materials, and related products for aircraft and commercial industries.

Dr. Carroll A. Hochwalt, vice president of research, development, and engineering of **Monsanto Chemical Co.**, named winner of the 1956 Midwest Award of the American Chemical Society's St. Louis Section.

Walter H. Meyer, named sales manager of the Vacuum Plating Div. of **Logo, Inc.**, will supervise the field development and sale of Logo vacuum metallizing finishes.

Morton B. Gilbert promoted to product specialist in charge of sales and product development for batch vacuum metallizing equipment of **F. J. Stokes Corp.**

Dr. Oscar J. Swenson elected to the board of directors of **The Carwin Co.**, North Haven, Conn. Dr. Swenson was formerly a consultant to Taylor Instrument Co., Tennessee Valley Authority, S. C. Johnson & Son, and Olin Industries. During his association with these companies, he was awarded a number of patents for process and equipment developments.

Alan W. Bryant, formerly in charge of the Boston office, now eastern district manager of the Sales Dept. of the **Carbon Black and Pigment Div., Columbian Carbon Co.** His headquarters will be at the New York general offices at 380 Madison Ave.

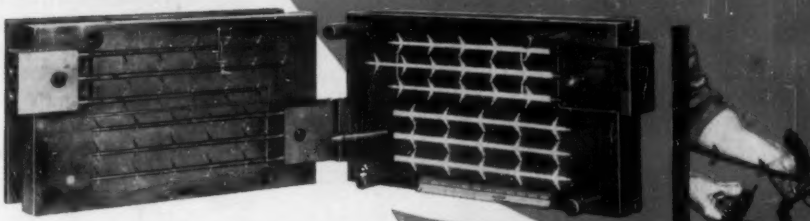
Dan B. Houser now sales engineer of **Federal Tool Corp.**, manufacturer of plastic housewares. He was formerly with P. R. Mallory Plastics, Inc.

Peter A. Castel named director of new products development, **Foster Grant Co.**, Leominster, Mass.

Dr. Hans K. W. Eckoldt, formerly with the patent department staff of Farbenfabriken-Bayer, A.G.,

★ ★ ★ in the modern manner

Parts for this life-like Warren Li-F-Time Christmas Tree produced from Cascade molds. Trees are manufactured by Warren Christmas Trees, Inc., San Bernardino, Calif., and the parts are molded by U. S. Plastics Co., Pasadena.



The Cascade molds shown above produce the Christmas tree parts from Hi Impact Styrene. The cycle is 110 shots per hour, using 7¼ ozs. of material on a 9 oz. press. **The first molds produced well over one million parts without signs of failure or need for maintenance.**

Cascade

plastic mold steel . . .

again does an excellent job!

The mold-maker, Caco, Inc., Pomona, Calif. selected Cascade because . . .

1. Prehardened Cascade eliminates heat treating problems. Economy demanded that all cavities be cut in one large block that would not be subject to size change during heat treatment.
2. With a prehardened steel, only one polishing operation was required.
3. Cascade polishes to a high lustre resulting in a superior finish on the molded parts.

The over-all dependability of Latrobe's Cascade pre-hardened plastic mold steel makes it the leading choice of molders and mold-makers everywhere. Cascade's uniform hardness and outstanding machinability, polishability, and weldability characteristics make it the finest steel for quality plastic injection molds.

Specify Cascade for your next plastic mold . . . large stocks are available for fast delivery!

LATROBE STEEL COMPANY

Main Office and Plant: Latrobe, Pa.
Branch Offices Located in Principal Cities

Companies . . . People

now associate patent counsel of **Mobay Chemical Co.** Dr. Eckoldt is the author of numerous scientific papers and publications, one of which is an encyclopedia of organic chemistry.

Donald E. Howell appointed to the newly created post of production manager of the Fabricating Div. of **G. Felsenthal & Sons, Inc.,** Chicago plastics fabricating and molding firm.

S. Sydney Minault, formerly general manager of the Equipment Div., named vice president of **National Research Corp.,** Cambridge, Mass.

John F. Blais appointed to the newly created post of marketing manager of **Catalin Corp. of America.** He will coordinate marketing requirements in the various specialized chemical and resin fields in which Catalin is engaged. Mr. Blais operated as an independent plastics and paper consultant for the past three years. Prior to that, he served 18 years with American Cyanamid Co.'s Plastics Div.; when he left, Mr. Blais was sales manager of laminating resins.

Robert R. Gehrett, Jr., formerly with the Plant Manufacturing Dept. at Lewistown, Pa., assigned to the Engineering Dept. at **American Viscose Corp.'s** Marcus Hook, Pa., plant.

Herman L. Moroson, on leave from the position of group leader of polyurethane and epoxy resin development at Reichhold Chemicals, Inc., appointed research fellow at the **Polytechnic Institute of Brooklyn.**

Dr. Harold J. Dawe, in charge of research and development of **Acheson Colloids Co.,** Port Huron, Mich., for over 10 years, appointed technical staff consultant of **Acheson Industries, Inc.,** the parent company. Dr. Dawe's new responsibilities will include the supervision of technical activities at all seven Acheson plants located in the United States, England, and Holland.

Willem L. J. De Nie, with the company since 1935, named assistant manager of the Licensing Div. of **Shell Development Co.** He was formerly assistant manager of the Market Development Dept. of Shell Chemical Corp.

Martin Aaron, materials engineer and executive in the plastics and chemical fields, named assistant to the president of **Sam Tour & Co., Inc.** and its affiliate, **American Standards Testing Bureau, Inc.** Mr. Aaron was formerly vice president of American Plastics Corp. and manager of technical procurement for Heyden Chemical Corp.

Dr. Paul J. Flory, professor of chemistry and acting chairman of the Department of Chemistry, appointed executive director of research of **Mellon Institute** to

---

Advertisers, Take Note!

The March issue of MODERN PLASTICS will be a particularly important one—a truly "special" issue for suppliers to the plastics market who are aiming to build sales on the West Coast.

Here's why. *Two* events of major significance to the plastics fields will be staged concurrently in Los Angeles in March: The 1957 SPI Annual Conference and the First Pacific Coast Plastics Exposition. Both are sponsored by The Society of the Plastics Industry.

Editorially MODERN PLASTICS will go "all out" in characteristically thorough fashion to tie in with these events. Feature articles will deal with Pacific Coast plastics developments. There will be detailed exhibit diagrams, schedules of events, attendance rosters.

Circulation-wise, the March issue will provide selective *added* distribution to cover whatever leading plastics-consuming firms on the West Coast that the magazine does not normally reach.

Timing of the issue will be just about ideal. Copies will be mailed to each subscriber before the end of February so that those who intend to go to Los Angeles can use it as an advance guide to both events.

Lowered advertising rates will be in effect for companies electing to limit their advertising to West Coast readers. Regular rates, of course, will apply to advertisers aiming to reach MODERN PLASTICS' full circulation.

For full details write today to Advertising Director,

MODERN PLASTICS
575 Madison Ave., New York 22, N. Y.

head its investigational activities. Dr. Flory has pioneered research on the constitution and properties of substances comprised of giant molecules, such as plastics, fibers, films, rubbers, and proteins.

Al Magida named district sales manager to cover New York and the New England states for **Alsynite Co. of America.**

John M. Vanselow, formerly with Libbey-Owens-Ford Glass Co., now field sales representative in the Philadelphia, Pa., area for **L.O.F. Glass Fibers Co.**

Harold H. Pomeroy joined the sales staff of **Chemical Process Co.'s** Plastics Div., Redwood City, Calif.

Clarence D. Bucher now western sales and service representative of **Falls Engineering & Machine Co.,** Cuyahoga Falls, Ohio, manufacturer of special machinery for the plastics and rubber industries, as well as V-belt molds and equipment.

Robert J. Snyder, former sales manager of the Sheeting Div. of Imperial Chemical & Plastics Corp., now sales manager of **Plymouth Rubber Co.'s Plastics Div.,** Canton, Mass.

Dr. J. G. Mackay, formerly works director of Avon India Rubber Co., Ltd., has joined the board of **Francis Shaw & Co., Ltd.,** Corbett St., Manchester, England, as technical director. The firm manufactures plastics, rubber, and hydraulic machinery.

Robert Derenski now manager of custom sales of the Plastic and Metal Divs. of **Santay Corp.,** Chicago, Ill., injection molder.

George H. Hand now industrial engineer at the Molded Products Div. of **Stauffer Chemical Co.,** Los Angeles, Calif.

Daniel D. Lewis, promoted to sales manager of **Durable Formed Products, Inc.,** will continue to service metropolitan New York, northern New Jersey, and southern Connecticut.

Classified Advertisements

Modern Plastics reserves the right to accept, reject or censor classified copy.

Employment

Business opportunities

Equipment

Used or resale only

Machinery and equipment for sale

FOR SALE: Equipment—Never Used: 310 Ton Water Chilling Set-up Complete with 300 H.P. Motor, Turbo Compressor, Speed Increaser, Chiller, Condenser, Controls, etc. John F. Carson, "A" and Venango Sts., Philadelphia 34, Pa. GArfield 6-2221.

FOR SALE: Lester injection Machines, others. 150 ton Hobbing Press, 50 ton 12"x12" Presses, 100—400 ton, 36"x36" platen Molding Presses. New ¾" 3000 psi Double Solenoid, 4 way Valves. New ¾" 3000 psi Cam operated Valves. Carver Laboratory Presses, factory reconditioned. New 6"x12" Laboratory Mills. Plastic Machinery Exchange, 426 Essex Avenue, Boonton, N. J., telephone DE 4-1615. Cable address "Plasmex Boonton."

VACUUM FORMER FOR SALE.
Save almost ½ on like-new Abbott two-station 60"x60" vacuum drape forming machine with vacuum pumps, dual timers, automatic oven and controls, dual blowers and duct work. Complete, ready for connection to your power and air supplies. Used only to make samples; never used in production.
Patton Hall, Inc.
2265 W. St. Paul Avenue
Chicago 47, Illinois. Tel: EVerglade 4-4714.

FOR SALE: 3—Ball & Jewell #2, #1½ Rotary Cutters; 1—Cumberland #0 Rotary Cutter; 4—Two Roll Mills 20"x22"x60", 15"x40", 6"x14"; 3—Baker Perkins 100 gal., 50 gal., 2 gal., jacketed double arm Mixers; 1—Stokes Rotary Preform Press #DDS2; 3—Stokes Model "R" single punch Preform Presses; 1—Kux Model 15-25 Rotary Press; Also: Sifters, Banbury Mixers, Powder Mixers, etc., partial listing; write for details; we purchase your surplus equipment; Brill Equipment Co., 2407 Third Ave., New York 51, N. Y.

FOR SALE: Two Freas temperature controlled ovens range from 150°F to 500°F. Inside dimensions 19 in. x 19 in. x 19 in. For more information write to J. H. Buckley Dental Laboratories, 406 Century Building, 130 Seventh Street, Pittsburgh 22, Pennsylvania.

FOR SALE: Cutters, Rotary, Plastic: Ball & Jewell #1 10 HP MD; Die Casting Machines: Loch Engineering, Zinc, Motor Drive, 10 HP; Extruders: NRM 1½" Elec. Htd. Wire Coating, Payoff and Takeup; 1¾" Elec. Htd. Laboratory Extruder ¾ HP Vari-Drive; Royle No. 1, 2" Screw 15 HP MD; Hartig 2" Elec. Htd. 7½ HP Reliance V-S Drive 98% New; Royle No. 1, 3 Stage oil Heated, Excellent Condition; Hartig 3¼" Elec. Htd. 45" Barrel 20 HP Reliance V-S Drive; No. 2 Royle 15 HP Motor, 3¼" Screw, Elec. Htd. Die Head; 4 Zone, Elec. Htd., 4" Screw, 60" Barrel, Practically New; Royle 4½" Elec. Htd. 30 HP V-S Drive; No. 3 Royle 30 HP Motor Drive, 4½" Screw, Side Delivery Q. O. Head; Adamson 6", 4 Speeds 40 HP MD. Strainer Head; Allen Williams 6" Pelletizing Head 60 HP MD. Injection Molding Machines: 1 oz. Van Dorn Model H-200; 2 oz. HPM No. 54 Clamp 22 Ton, Injection 12 Ton, Manual Controls; 2 oz. NRK No. 1300 Plasticor Vertical, Hand Operated; 2 oz. Watson-Stillman, Frame 6 oz. Cap., Motor Drive 20 HP, 1945; 2 oz. Watson-Stillman Vertical Motor Drive; 3 oz. Fellows Fully Automatic; 4 oz. DeMattia Semi-Automatic; 4 oz. Crown Moldmaster Complete Fully Automatic; 4 oz. Reed Prentice Wheelco Controls 15 HP MD; 6 oz. Watson-Stillman With 2 Wheelco Controls; 8 oz. Reed Prentice Double toggle; 8 oz. Impco Mdl. VF-8, Compress. & Transf. Features, Extra 12 oz. Cyl.; 9 oz. HPM 200 Ton Fully Automatic; 16 oz. Reed-Prentice No. 10-E-16, Electric Heated, 1948; 22 oz. Impco, Model VF 8-22; 24 oz. DeMattia Model B, Inspect in Operation. Mills, Rubber, Plastic: 6"x13" Farrel Laboratory 7½ HP Md; 16"x40" Farrel, Rubber/Plastic; 16"x48" Farrel, Rubber/Plastic; 18"x50" Farrel, Rubber/Plastic; No. 2 Abbe Eng. Co., Eureka Porcelain Jar Mill, Roller Chain, Motor Drive (2); 20"x22"x60" Birmingham 3 on one line, 200 HP Motor and Drive. Presses, Hydraulic: 2 Ton Denison 3 HP MD; 5 Ton, Logan, Twin Ram 7½ HP, MD; 15 Ton, Stokes No. 200D-2 Automatic (10); 15 Ton Consolidated Self Contained; 20 Ton, Elmes No. 3429P Laboratory, Electrically Heated Platens 8"x8"; 25 Ton Consolidated 24"x30" Self Contained Pump & Motor; 30 Ton, Watson-Stillman Laboratory, Platens 8"x8" (2); 30 Ton Watson-Stillman 4½" Ram x 18" Stroke 12½ LR-16" F-B 22" DLO MD; 30 Ton, Baker, Full Automatic Model 958, Excellent Condition, New 1951; 30 Ton, HPM Upmoving 12"x12" Platen 12" DLO 12" Str with Controls; 35 Ton, HPM Down-Acting, Ram 6"x6" Str., Bed 12"x6", DLO 15", Self-Cont.; 40 Ton, Francis 4 Opening, 12"x12" Elec. Heated Platens; 40 Ton, Loomis, 4 Opening, 12"x12" Elec. Heated Platens, MD Self-Cont.; 50 Ton, Baldwin-Southwork Angle Molding Press, Practically New; 50 Ton Bliss 20"x20" Platen 20" Str. 60 HP MD; 50 Ton, Stokes, Semi-Auto., Self. Cont.; 50 Ton Farrel 12"x12" Upmoving; 50 Ton, Watson-Stillman, 12"x17" Elec. Htd. Platens, MD Pump; 60 Ton Weaver Bet. Housings 42"; 60 Ton Elmes Hydr Straightening Press; 75 Ton, Farquhar, Up-Acting, 30"x42" Platens; 100 Ton, Farquhar, Drawing, Stroke 36", Hi-Speed Appr., Press, Return; 100 Ton, Farquhar, Self-Cont., Down Acting Ram 11"x26" Str. 30"x28"; 100 Ton Stokes Standard Semi-Automatic Power System Timing Controls; 100 Ton, Watson-Stillman, Platens 13"x13", Ram 8½"x3" Str., Md Pump; 100 Ton, HPM 72" STR Platen 30"x30" 84" DLO Fast Acting; 100 Ton, Watson-Stillman, 4-Post, Platens 11¾"x 12", Ram 8"x15" Stroke; 100 Ton, Watson-Stillman, Bed 22"x20", DLO 24", Self. Cont.; 100 Ton, Lake Erie Hi-Speed, 24"x24" Bed, 12" DLO, Self. Cont.; 113 Ton French Oil Mill 6 Opening Elec. Htd. Platens 15"x18"; 113 Ton R.D. Wood 5 Opening Elec. Htd. Platens 14"x 20"; 113 Ton Stewart Bolling 20"x20" Steam Platens 12" Upmoving Ram x 14" STR; 150 Ton Stokes Standard Semi-Automatic Power System Timing Controls; 215 Ton Lake Erie Self. Cont. Semi-Auto Bed 36"x36"; 150 Ton Carey, Platens 20"x16" Adj., DLO 8"-28"; 175 Ton Viceroy Slab-Side 24"x24" Elec. Htd. Platen with Hand Pump; 200 Ton Elmes 14" Ram x 42" Str. 24"x30" Bed; 225 Ton Farrel 14" Ram x 18" Stroke L-R 26½"x F-B 24½" 7½ HP MD; 275 Ton Watson-Stillman Upacting 24"x54" Platens 2-14" Ram; 300 Ton Watson-Stillman Transfer Press 33"x27" Platen, Auto.; 550 Ton, Elmes, Self-Cont., Down Acting., Ram 19"x20" Str., 30"x36"; 600 Ton, Watson-Stillman, Hobbing, Motor Driven Pump; 625 Ton, Farrel, Steam Platens 52"x52", Pump, Mtr., Controls, Under Power; 669 Ton, Morane, 3 Upmoving Rams, 16" Stroke; 750 Ton, HPM, Down Act., Bed 59"x44", DLO 72" Ram 28"x43" Str.; 1200 Ton, HPM, 15 Openings, 100"x120" Steam Platens, Self-Cont. (2); 2400 Ton, Birmingham, Belt Press, 65"x26'6", 24-11" Rams; 4000 Ton Mesta 3 Opening 30" Rams x 20" Str. Bed 34"x351". Pulverizer: Model #W30-H-SP Buffalo. Furnaces and Ovens: Megatherm, 3/CO/220, 3 KW, 2-3 lb. Phenolic Per. min. (8); Despatch Mdl. Diaz-7583, 3 Drawers, 17"x17"x5" (2); Despatch Mdl. Plhd-8, 8 Drawers, 12x18x2½" (2); Thermonic Induction Heater Model M-285 12 KVA at Full Load; Gehnrich Gas-Fired 6'x6'x6' Walk-in Heat to 400°. Tablet Machines: Model 280-C Stokes 100 Ton Single Punch; Model G-4 Stokes Single Punch Dual Pressure 15 Ton MD; Model T Stokes, Hydraulic Equalizer, Motor Drive, 3 HP; Model R Stokes, Single Punch, Variable Speed Motor Drive, 3 HP; No. RB-2 Stokes, 16 Station, Motor Drive, 2 HP; Model 45 Defiance, 200 Ton, 15 HP, Vari-Speed, MD; Model 61 KUX 30 Ton Single Punch; No. 2 RP Colton, 16 Punch, Rotary, Motor Drive 1½" HP; No. 3 RP Colton, 16 Punch, Rotary, Motor Drive 1½" HP; No. 3 DT Colton 25 Ton Single Punch; No. 280G Stokes, Single Punch Dual Pressure; Model F, Stokes, Single Punch, MD; No. 5 Arthur Colton, Motor Drive, 3 HP; No. DD-2 Stokes, 19 Stations, US Vari-Drive, 10 HP; No. DDS-2 Stokes, 23 Stations, US Vari-Drive, 10 HP; No. DD-2 Stokes, 23 Stations, Reeves Vari-Speed Drive 7½ HP; Model E Stokes Single Punch 2 Ton Vari-Speed MD; No. P-3 Stokes 80 Ton Dual Pressure 15 HP Vari-Speed Drive; No. 291 Stokes Dual Pressure 60 Ton 7½ HP MD. Pumps: 200CPM, 2500 Psi Worthington Horizontal, Duplex, DA 3¾"x18"; 7½ Gal. Pennison Model PUV 3.75 1000 lb. 3 HP Motor T Tank. Mixers: 100 Gal W & P Jacketed Sigma Blades Air Cylinder Tilt; No. 3A Banbury, 150 HP MD Rubber/Plastics; No. 3 Banbury, 150 HP MD Excellent; No. 9 Banbury, Body Only; 5 Gal. Patterson-Kelly Stainless Steel Realtor with Agitator ¾ HP MD Elec. Htd.; No. 11 Banbury Body Only; 80 Qt. Reed Vertical 3 Speed HP MD. Calenders: 9"x48" American Tool, 2 Roll Doubling, Belt Drive, Rubber, Plastic; 24"x48" Farrel-Birmingham, 3 Roll, 50 HP DG Motor; 14" Web John Waldron 2 Roll Embossing Calender 3 HP Vari-Speed, Never Used. Take-Up-Equipment: 30" Royle, Cable Take Up; 36" Royle, Capstan, Take-Up. Trimmer: 50 Ton Model Metal Stamping Trimmer Model 1C-¼-6 Fully Automatic. Impregnators: No. 56 Av. Stokes Vacuum with Storage Tank 29¼" Dial x 42" Vac. Pump; No. 154-1 Barret, Bowl DIA. 18" x 8", Cap. 2000 Cu. In. MD. Paint/Ink Mills: 5" x 12" 3 Roll J. H. Day Lab Mill. Pelletizers: Mitts & Merrill Model 10-H-6 15 HP V.S. Drive. Reactors: 5 Gal. Patterson-Kelly, Stainless Steel. Elec. Htd. with Agitator. Johnson Machinery Co., 673-P Frelinghuysen Ave., Newark 5, N.J. What Do You Need? What Do You Have to Sell?

(*Continued on page 298*)

(Continued from page 296)

FOR SALE: Injection Molding Machines: 16 oz. Watson-Stillman (1948 model), 12 oz. Lester, 8 oz. Reed-Prentice (1946, 1949 and 1950 models). All in excellent running condition. Priced to sell. Reply Box 1623, Modern Plastics.

FOR SALE:
Moslo 2 oz. Injection Moulding Machine. Model 73 with special cylinder for running nylon. Used very little. Will sacrifice to make room for larger equipment.
Standard Plastics, Inc.
Attleboro, Mass.

FOR SALE: Vacuum Metallizer Stokes 36". Injection Presses: 8,12,24 oz. Reed, 4,9,16 oz. HPM. 12 oz. Watson. 6,8,12,20 oz. Lester. 8 oz. vertical Giddings & Lewis. 4 oz. Lewis. 1 oz. Van Dorn. Extruder conveyors. Scrapgrinders. Ovens. Compression & Transfer presses: 50 to 600 tons. 30 T. Hydrolair Elmes. 2 KW Cutler-Hammer electr. Preheaters. Vacuum Forming Machines: Auto-Vac 52"x 30", Comet 36x48" double table drape. Abbott M 60 drape double table.—Autom. Spray Mask Washer. Day-Mixer size 0. All Midwest locations. List your Surplus Equipment with me. Justin Zenner, 823 Waveland Ave., Chicago 13. Ill.

FOR SALE: Hartig 3¼" Plastic Extruder. VanDorn 1 oz. Injection Molding Machine. Stokes R, 2½", single punch, Preform Machine, Kux 2½" dia., single punch Preform Machine. Farrel 15" x 36", 2-roll mill. Mills and Calenders up to 84". New Seco 6" x 13" and 8" x 16" Lab. Mixing Mills and Calenders. Plastic and Rubber Extruders. Oxford 57" Slitter. 600 ton laminating press with 23 openings 26" x 38". 300 ton laminating press with 10 openings 40" x 40". Brunswick 225 ton 21" x 21" platens. Farrel 200 Ton 30" x 30" platens. 200 ton Hobbing Press 18"x14" platens. D & B 140 ton, 36" x 36" platens. D&B 150 tons, 24" x 24" platens. Adamson 80 ton. 20" x 20" platens. Farrel 200-ton 20" x 80" platens. W.S. 40 Ton self-contained with 12" x 12" elect. heated platens. Also Lab. to 2000 tons from 12" x 12" to 48" x 48". Hydr. Pumps and Accumulators. Stokes Automatic Molding Presses. Rotary and single punch Preform Machines, ½" to 4". Injection Molding Machines 1 oz. to 60 oz. Baker-Perkins & J. H. Day Jacketed Mixers. Plastic Grinders. Gas Boilers. Partial listing. We buy your surplus machinery. Stein Equipment Co., 107-8th Street, Brooklyn 15, New York. Sterling 8-1944.

FOR SALE: Continuous Process Extruding, Vacuum Forming and Blanking Operation Setup with 4½" N.E. Extruder electr. heated, most modern installation in "as new" condition available at considerable saving. Inspection invited. Contact Justin Zenner, 823 Waveland Ave., Chicago 13, Ill.

FOR SALE: One used 10 ton Carver Laboratory Press, reconditioned and guaranteed. Reply Box 1624, Modern Plastics.

FOR SALE: 1—Modern Plastics 1¼" electric extruder; 1—Stokes standard 150 ton molding press; 2—Stokes model R, T preform presses; 7 Cumberland #½ granulators, 3 HP; 1—Cumberland 14" rotary chopper; 1—Watson Stillman 50 ton electrically heated molding press; Also mills, calenders, slitters, etc. Reply Box 1625, Modern Plastics.

FOR SALE: Stainless Steel Rotary Dryer. Link Belt Co., 5'2"x16". No. 502-16, with all aux. equip. Roto louvre also 6'x24' and 5'x26'. Hersey Stainless Steel Rotary Driers. Reply Box 1610, Modern Plastics.

FOR SALE: One Polyethelene sheeting die, 42" complete with cast aluminum heaters. Reply Box 1645, Modern Plastics.

FOR SALE.
Lester type L-2-8 Injection Molding Machine, 8 oz. capacity, complete with instruments. Excellent running condition, immediate delivery. Can be seen in operation.
Sterling Plastics Co.
1140 Commerce Avenue
Union, New Jersey

FOR SALE: Marco Process consisting of: Homogenizer, Roto-Feed Mixers, Reactors, Kom-Bi-Nators and pumps, all stainless steel. Heavy Duty Double Arm Sigma Blade Mixers. (2) Readco 50 gal. 30 HP; (2) W & P 50 gal. and 100 gal: (4) J. H. Day 5, 50, 75, 200 gal. stainless steel. (2) Kux Rotary Pellet Presses. (4) Horizontal Ribbon Mixers 336 cu. ft. (12,000#) capacity. Stainless Steel Reactors or Autoclaves—1420 gal., 465 gal., ½ gal. (1) St. St. Pug Mill 7" diameter x 3'9" long overlapping chambers, jacketed 75#. (4) Mikro Pulverizers #2DH, #2TH, #3TH. (3) Fitzpatrick Stainless Steel Comminuting Machines, Models D, K & F. We Buy Your Surplus Equipment. Perry Equipment Corp., 1429 N. 6th St., Phila. 22, Pa.

NEW ARRIVALS FOR SALE: French Oil Mill Mchy. Compression Molding Presses; 75-170 tons, 3-170 tons, 35"x18", 5-95 tons 29"x18", 3-75 tons 18"x17", 5 Preheaters 2 KW, Wood 20"x20" 12" ram 170 tons; Southwark 24"x24" 12" ram. 170 tons; Baldwin Southwark 4-26"x26" 8" rams, 75 tons; 5-26"x26" 7" rams 57.7 tons; 2-15"x15" 8" rams 75 tons; 2-19"x24" 10" rams, 78 tons; 2-12"x12" 7½" rams 66 tons; 2-D&B 12"x12" 7" rams, 57.7 tons; 8"x9" 4½" rams, 24 tons; D&B 12"x12" 3" rams, 10 tons; HPM Transfer Molding 75 tons; Preform Presses, Colton 5½T Stokes R and DDS-2MD; New Universal Dual Pumping Units 3-15 HP; Lab. Mills and Calenders; also Extruders, Mixers, Vulcanizers, Injection Molding Units, etc. Universal Hydraulic Machinery Co., Inc., 285 Hudson St., New York 13.

FOR SALE: Warner Model 100 Laminating Press, 950 Vinyl Sheets 6"x8" Different Colors, 12 Acrylic Sheets, 300 White Blotters, 8 Polish Plates, 1 Operator's Instruction Manual. Value $375. Half Price or Best Offer. Reply Box 1618, Modern Plastics.

INJECTION MOLDING MACHINES
—New Machine Warranty—10D—8 oz. Reed, 300T—12/16 oz. Reed, 450T—20/24 oz. Reed.
Reply Box 1622, Modern Plastics

FOR SALE: 1—Royle #4 Extruder, motor driven; 1—6"x12" Laboratory Mill, m.d.; 1—Ball & Jewell Rotary Cutter, size O m.d.; 2—Baker-Perkins Size 15, 100 gal. Jacketed Mixers: 5—Horizontal Dry Powder ribbon Mixers, 4000#, 1500#, 500#; 1—New 3 Roll 6"x16" Laboratory Calender; 1—Farrel-Birmingham 60" Mill with reduction drive, 150 HP motor, floor level mounting; 1—Fitzpatrick "D" Comminutor, S.S. contact parts, jacketed; 1—Mikro Pulverizer #2th, with motor; 4—Reed-Prentice & W-S Injection Molding Machines , 2-16 oz.; Also other sizes: Hydraulic Presses, Tubers, Banbury Mixers, Mills, Vulcanizers, Calenders, Pellet Presses, Cutters. Send us your inquiries. What have you for sale? Consolidated Products Co., Inc., 50 Bloomfield Street, Hoboken, N. J. HOboken 3-4425, N.Y. Tel.: BArclay 7-0600.

FOR SALE: (11) 75 ton record presses, complete @ $2,450, (11) new 100 ton, 10" ram, 10" stroke @ $1,100, (8) 200 ton, 9" stroke, 14" ram, 36x36 @ $1,850, (7) 200 ton, 9" stroke, 15" ram, 30x30 @ $1,650. (1) 50 ton complete. 18x18 @ $1,850. (1) 200 ton, 16" ram, 30x30 @ $2,450. (2) 200 ton, 16" ram, 42x42 @ $2,850, (1) 200 ton 15" ram, 42x42 @ $2,450, (4) 250 ton, (2) 12" rams, 30x60 rebuilt @ $3,375. Hydraulic Sal-Press Co., Inc., 388 Warren Street, B'klyn, N. Y.

FOR SALE: Injection molder—64 ounce, with pre-plasticizer, 750-ton clamp; mold size 32 inches vertical and 50 inches horizontal—(2) 300 Ton W.S. Presses 20x 20 & 29x24 Platens. 140 Ton W.S. 22x16 Platen. 85 Ton Waterbury Farrel 20x24 Platen. 63 Ton Press 15x15 Platen with Pullback Cyls. 8, 4, Oz. Injection Molding Machines. 15 Ton Lab. Presses 10x8 Platen. 10 Ton Lab. Presses 6x6 Platen. Standard Mystic Embossing Presses. Accumulators, Pumps, Valves. 250 Ton W&S 28x24 Platens, 80 Ton Farrel 24x24 Platens. Many other Presses—Send for Bulletin. Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y. Tel.: WAlker 5-8300

FOR SALE: One 3½" Modern Plastic Extruder; One 34" stainless steel Sheeting Die for vinyl extrusions; Two Screws; One Takeup with two cooling or heating rolls, trim knives, pinch roll, slip clutch, vari-drive; One Polishing Roll Unit steam heated; One Beck automatic Roller Sheet Cutter; One Type 30 Ingersoll Rand Air Compressor 3 HP and an 80 gallon tank; One Foremost Plastic Scrap Chopper. Reply Box 1635, Modern Plastics.

FOR SALE: Abbott APM-41—For skin packaging or vacuum forming; 2-station, automatic oven and timers, 40 inch bed. Machine never used in production. Must sell to settle estate. Also laboratory model, APM-20, manual, 14 x 14. Jerome E. Ross & Co., 939 West Lake Street, Chicago 7, Illinois.

FOR SALE: Complete raw material to finish Phenolic Mixed Material Plant, Never Used, in Original Crates. Will sell all or part. 1) Two plastic Mills, 24"x 60", Farrel Birmingham, complete with all controls, motors, gear reducers, Price: $40,000 each; 2) Horizontal Batch Premixers—(2 available) 6,000# capacity; 3) Special Brush Type Sifter—6,000#; 4) Rotary Air Seal Feeder; 5) Slide Valves —5,000#; 6) Hammer Mills (2 available), 4,000#; 7) Saw Tooth Crushers (2 available)—4,000#; 8) Chip Cooler, 4000# per hours; 9) Knife Cutter, 4000# per hour; 10) Gyrator Sifter, 4,000#; 11) Automatic Bulk Weighing Scale—12,000# per hour; 12) Vacuum Pneumatic Conveyors—12,-000# per hour (2 available); 13) Rotary Batch Blender—6,000#; 14) Scalping Screen—8000 lbs. per hour; 15) Ball Mill; 16) Atmospheric Dryer; 17) Dust Collector. The Above Eqt. ran—$350,000 and will sell reasonably. If interested—Call or wire for any further details you may need. Price—Subject to Negotiation. Eveready Supply Company, 803-5 Housatonic Ave., Bridgeport 4, Conn., Telephone: EDison 4-9471-2.

FOR SALE: With one year full service guarantee, all surplus hydraulic machinery, plastic working equipment, engineered and re-built to most exacting production requirements, including Stokes, Baldwin and H.P.M molding presses up to 300 tons. Two 300 ton laminating presses 48x42. Four 170 ton 17x16 platen, fully guided, any required d.l. Listings on manufacturers surplus equipment for disposal include, in good condition; 8-12-16 and 20 oz. injection molding presses, Defiance 75 ton preform press. 200 ton F.O.M. transfer press. Hartig 4½ extruder. New custom-built to operating requirements for any hydraulic press, Dua-matic power units with complete hydraulic system for automatic timed or manual cycling, volume up to 100 GPM, pressure to 6000 PSI. Any plastic working machine procured on commission or service charge basis, including our thorough inspection and survey. Give us your plastic machinery requirements for competent engineering sales service covering the plastics industry only. We solicit manufacturers surplus listings and those of dealers in machine tools, disposing of hydraulic machinery and plastics processing equipment. J. F. O'Connor & Son, Hydraulics Industrial Service, 2020 Renfrew Ave., Elmont, New York.

FOR SALE: 60 oz. H.P.M. w/1200 ton clamp; 60 oz. Reed-Prentice, 1951; 48 oz. H.P.M., Model 400P 1955; 32 oz. Reed-Prentice, 1950; 22 oz. Impco vert.; 16 oz. Impco w/10 oz. cyl. & center injection; 16 oz. Watson-Stillman, $10,000; 12/16 oz. DeMattias, Model M; 16 oz. H.P.M. 1945, $9,000; 20 oz. Lester 1953; 12 oz. Lester 1952, $12,000; 12 oz. Reed-Prentice; 9 oz. H.P.M. 1953; 8 oz. Reed-Prentice, $6,500; 8 oz. Reed-Prentice w/10 oz. cyl., $6,000; 6 oz. Fellows, 1955; 6 oz. Lester, $3,750; 6 oz. Watson-Stillman vert; 4 oz. Lester vert; 4 oz. Acme, 1953, $5,500; 4 oz. Lewis, 1950; 4 oz. DeMattia vert., new; 4/6 oz. Reed-Prentice, 1954; 4 oz. Lesters, 1953, w/low pressure closing & Nylon cut-off; 4 oz. Reed-Prentice, $3,000; 2 oz. Van Dorn, $1,750; 1 oz. Van Dorn, $975; 2½" N.R.M. extruder; Stokes presses; all types new & used plastic machinery —Let us list your surplus equipment. Acme Machinery & Mfg. Co. Inc., 2315 Broadway, New York, N. Y. Su 7-1705.

(Continued on page 300)

assurance to vinyl compounders—

INDOIL

OXO ALCOHOLS

are evaluated in finished plastic compounds

INDOIL Oxo Alcohols produce uniformly high quality plasticizers. This is regularly check-tested in finished plastic compounds by INDOIL's plasticizer evaluation laboratory. Compounders and molders get this benefit and assurance when they specify plasticizers made with INDOIL Oxo Alcohols.

If you are manufacturing vinyl products that require:

- Low volatile loss
- Resistance to extraction
- Low temperature flexibility
- Good electrical properties
- Resistance to heat and light

check your esterifier. Get plasticizers manufactured from INDOIL Oxo Alcohols.

INDOIL plasticizer evaluation laboratory checks quality of INDOIL Alcohols by testing derived esters in finished vinyl compounds. Here operator prepares a vinyl compound.

Testing low temperature flexibility at INDOIL plastics evaluation laboratory.

Instron data are recorded to determine equivalent modulus concentration. Staff of trained plasticizer chemists make evaluations.

Typical properties of esters prepared from INDOIL Oxo Alcohols

	DIOP	DDP	DIOA
Specific Gravity 20/20	0.981	0.965	0.928
Color, APHA	<25	<25	<25
EMC* phr at 1,600 psi	51.4	53.7	43.6
Refr. Index n_D^{20}	1.486	1.484	1.447
Visc. cs at 20°C.	74	120	18
Temp. at 100,000 Stokes, Vis., °C.	–42	–39	–70

*Equivalent Modulus Concentration

For additional information, write for INDOIL Oxo Alcohol Bulletins.

INDOIL CHEMICAL PRODUCTS

INDOIL CHEMICAL COMPANY

910 South Michigan Avenue, Chicago 80, Illinois

WAlker 5-8300

(Continued on page 300)

(*Continued from page* 298)

Machinery and equipment wanted

URGENTLY WANTED: By J. F. O'Connor & Son, Elmont, N. Y. 200 to 400 ton Hydr. Press. Preferably with a die cushion. Will give up to $15,000 for late type. Also 75 ton Preform Press and W.S. 200 to 300 ton Trans-Molding Press. Down Acting Ram: Trans. Ram on bottom. Up to 100 ton 15x15 Multiple Platen Press and all types Molding Presses and Injection Molding Presses. Hydraulics Industrial Service. J. F. O'Connor & Son, Elmont, New York.

WANTED: Vacuum Coating Equipment Wanted. Give Full Description Including Age, Make, Size and Price in Your Letter. Also on the Market for Used Molding Equipment up to 12 Oz. Reply—Tee Vee Toys, Inc., 124 Water Street, Leominster, Mass.

WANTED: One used Van Dorn one or two oz. injection molding machine. Reply Box 1605, Modern Plastics.

WANTED: Used 4 to 6 oz. injection molding machine. Must be in good running condition. Furnish machine specifications, number of tie bars, weight, age, location and price. Reply to: L. D. Edwards, 1016 Winchester, Medford, Oregon.

WANTED: Phenolic Resin Kettle—suitable for pilot plant operation—5 gallon capacity—stainless steel—jacketed. Send full descriptive details and price. Rogers Corporation, P. O. Box 147, Rogers, Connecticut.

Materials for sale

FOR SALE: Lester 12 oz. Fully Automatic Plastic Injection Molding Machine; (2) Lester 6 oz. (Model 2B) Automatic Plastic Injection Molding Machines; (2) Lester (Model HHP2) 5# Die Casting Machines; Stokes Model "F" Preform Press; Stokes Model S4 Tablet Press 40 Ton; Stokes Model P3 Press 80 Ton. We also recently liquidated a Plastic Button Plant and will sell: Plastic Button Molds and Dies; Urea, and Phenolic Molding Powders (all colors); Tumbling & Waxing Barrels; Stokes Granulator; Day Blender; Four Slide Wire Formers for Loops; Button Tack Wire Formers; Button Circle Insert Formers; Button Fastening Machines. All equipment is in very good condition, just as removed from service in the Plant. Write for complete information, we will furnish sample buttons that the Dies made and be happy to fully cooperate with interested parties. Globe Trading Company, 1815 Franklin St., Detroit 7, Michigan. Phone: WOodward 1-8277.

FOR SALE—PLEXIGLASS BLOCKS.
20,000 pieces, new, clear, not cracked or crazed. Government Surplus USMC Tank Periscopes, Type M-2. This new block of clear plastic especially suitable for internal carvers and novelty manufacturers. Weight 5 lbs. 11½"x 6½"x1¾". Price $1.65 each in gross quantities. For details write/call
Central Tire & Salvage Co.
9101 So. Alameda St.
L.A. 2 Calif., Telephone LOrain 9-7175

Materials wanted

WANTED.
Plastics Scrap and Rejects of all kinds. Ground and unground. Also rejected molded pieces and surplus virgin molding powders. Top prices paid.
A. Bamberger Corporation
703 Bedford Ave., Brooklyn 6, N. Y.
MAin 5-7450

WANTED: Plastic Scrap. Polyethylene, Polystyrene, Acetate, Acrylic, Butyrate, Nylon, Vinyl. George Woloch, Inc., 601 West 26th Street, New York 1, N. Y.

WANTED: Plexiglass and Lucite scrap, salvage and cut-offs, any quantity. Turn your surplus sheet stock into cash. Ask for our quotation. Duke Plastics Corp., 584 Broadway, B'klyn 6, N. Y. EVergreen 8-5520.

WANTED: To buy by Injection Molder—Polystyrene regrinds, clear and light colors. Reply Box 1621, Modern Plastics.

WANTED: Large quantity of polystyrene, scrap, ground and unground, or surplus virgin material. Light colors. Highest prices paid direct by midwest injection molder. Reply Box 1643, Modern Plastics.

WANTED: Thinking of Selling Scrap? Call Gem City, your best market for nylon, styrene, acetate, butyrate, acrylic and polyethylene in all forms. For quick, courteous, sincerely honest service, you owe it to yourself to try Gem City Trading, P. O. Box 941, Dayton 1, Ohio. HEmlock 2121.

SCRAP WANTED.
Acetate, Butyrate, Polystyrene, Acrylic, any quantity. Also list your surplus inventory of Virgin molding material with us for sale at highest prices.
Claude P. Bamberger, Inc.
1 Mount Vernon St.
Ridgefield Park, N. J.
Tel: HUbbard 9-5330. Not connected with any other firm of similar name.

Molds for sale

FOR SALE: Complete line of Houseware Molds, Comb Molds, also some novelty and specialty items. No reasonable offer refused. Send for list. Reply Box 1644, Modern Plastics.

FOR SALE: Detroit Mold Base No. 1826A-21 complete. Unused. Die-Temp Mold Temperature Controller, Model R42153—Serial 53-5001 complete with pump, switches and 4,000 watts controlled heating element, 3 phase, 60 cycle, 220 volts—used very little. Both priced to sell. Kiddie Brush & Toy Co., Jonesville, Michigan. Phone VIctor 9-6351.

Molds wanted

WANTED.
Used molds for plastic pipe fittings. Reply Box 1604, Modern Plastics.

WANTED: Molding Dies for Ball Knobs, Control Knobs, etc. Send full particulars, prices and samples to: Rogan Bros. 8031 N. Monticello Ave., Skokie, Ill.

MOLDS WANTED.
We Rent Molds and Use Them No More Than 30 Days. Suitable for 4 and 8 oz. presses. Housewares, toys, novelties and any other items. Largest Cuban plastic molders with long experience in handling foreign molds under rental basis. We offer guarantee and security. Submit samples and quotations to:
P.O. Box 2254, Havana, Cuba.

Help wanted

TECHNICAL SALES-SERVICE.
B.S. Chemistry; age about 30; industrial and technical sales-service experience. Good growth potential with expanding chemical specialty company. Extensive traveling, possible relocation. Send complete resume, earnings, etc.
Reply Box 1640, Modern Plastics.

PLASTICS INJECTION MOLDING: Assistant Superintendent to handle 3 shifts. Must be thoroughly experienced in die set-up, trouble shooting and quality control. Excellent opportunity for right man in Southern California. Reply Box 1606, Modern Plastics.

TILE ENGINEER.
Vinyl tile Engineer or chemist required for new plant. Must have at least two years experience. Excellent opportunity for professional development. Salary commensurate with ability and training.
Reply Box 1613, Modern Plastics.

VINYL COATINGS: We have a career opportunity for a man with at least five years' experience in formulating and developing vinyl coated products, using the plastisol or organisol techniques. His major activity should have consisted of development of products on paper or fabric backings. Plant production experience is highly desirable. We are the oldest manufacturer of floor and wall coverings in the country, with excellent employee benefits; a nationally known, multi-plant, progressive organization. Write with full resume including salary desired to Warren F. Bietsch, Personnel Administrator, Congoleum-Nairn Inc., 195 Belgrove Drive, Kearny, New Jersey.

SALESMEN:
We have just completed another expansion in our plastics division and are looking for additional salesmen to handle our line of custom extrusions, injection moldings, and fabricated items to all industries. Inspection of our various plants will be arranged for at our expense to proper interested parties.
Ben Faneuil, President
Chelsea Industries
Chelsea, Mass.

INDUSTRIAL FIBER GLASS SALESMEN.
Major weaver of glass fabrics has openings for several salesmen with experience in reinforced plastics, resins or industrial fabrics. Opportunities are available selling woven fiber glass and other industrial synthetic fabrics in branch sales offices located in Boston, Dallas, Chicago and Detroit. Salaried positions based on ability. All inquiries held in strict confidence. (Our industrial sales staff knows of this ad.) Send complete resume, including detailed experience, age and past earnings.
Reply Box 1638, Modern Plastics.

PLASTICS EXTRUSION OPERATOR & Ass't Extrusion Foreman: Wanted by Progressive New York City firm. Pleasant working conditions, chance for advancement unlimited by "seniority" and other restrictions. Excellent opportunity for right man—applications treated with strictest confidence. Write, giving full details to: President, Box 1609, Modern Plastics.

PROJECT LEADER.
M.S. or Ph.D. in Chemistry or Chem. Engineering. To plan and carry out Research and Development work relating to the combination of plastics and paper by coating, impregnation, extrusion, and lamination. Also, to devise new and improve methods of imparting barrier properties onto paper. Three to five years experience in paper coatings are required. A thorough knowledge of polymer chemistry and paper-coating equipment is essential. This new and expanding research facility presents an excellent opportunity to grow with the organization. Send details of education, experience, and personal data to:
Director of Research
West Virginia Pulp and Paper Co.
Mechanicville, N.Y.

VINYL COLOR MATCHER.
Man experienced in color matching and production color control in film and sheeting. Reply Box 1607, Modern Plastics.

(*Continued on page* 301)

(*Continued from page* 300)

PRODUCTION MANAGER: Experienced man in Thermosetting molding field. Full knowledge of all phases of molding and finishing required. Knowledge of automatic molding equipment desirable but not essential. Particular emphasis on knowledge of tooling. Progressive firm in Chicago area with excellent future for the right man. All replies held in strictest confidence. Reply Box 1632, Modern Plastics.

PLASTIC TECHNOLOGISTS.
Do you feel you are in a rut on your present position? If so, and you have experience in injection, compression and some extrusion molding work and are ambitious, aggressive technicians familiar with molding processes, layouts, quotations, and estimates, ability to carry assignments through development and production stages. Excellent future with the right position for the right man. Many fringe benefits provided for. Opportunity with a large corporation located in Midwest. Replies will be held in strict confidence.
Reply Box 1615, Modern Plastics.

EXTRUSION VACUUM FORMING ASSISTANT PLANT SUPERINTENDENT: A Chicago area corporation has an exceptionally fine position for a man with extrusion experience and real mechanical ability. This job is for someone with the right background and personality to handle production and assist the superintendent in this newest plastics process. Permanent position. Excellent future. Salary open. Replies held confidential. Reply Box 1630, Modern Plastics.

EXPERIENCED INJECTION MOLDING SUPERINTENDENT.
With Mechanical or Chemical Engineering Background for well-known New England Manufacturer. All inquiries held confidential.
Reply Box 1616, Modern Plastics.

COME TO FLORIDA: We have opening for experienced fabricator and molder of Acrylic Plastic. Experience in free blowing and grease forming necessary. Capabilities in mold designing desirable. Excellent opportunity for a creative mind. Expanding firm in the heart of South Florida's industrially growing area. Give complete resume. Luminous Plastics, Inc., 510 N. W. First Avenue, Fort Lauderdale, Florida.

EPOXY RESINS.
We have openings for chemists and chemical engineers with or without experience for product development of epoxy resin compounds and converters and to explore new uses for these compounds in plastic tooling, encapsulating, adhesives, laminating, electrical applications, etc. For one of these openings we would prefer a chemical engineer with a good background in electrical engineering. If you are interested in the future of epoxies and want to become associated with the Plastics Technical Service Laboratory of the Company who has pioneered in this field, forward resume and availability for an interview to:
C. M. Jackson
Coordinator, Technical Div.
Devoe & Raynolds Company, Inc.
Box 328
Louisville 1, Kentucky.

PLASTIC ENGINEER: Design & development of plastic products, processes and tooling for fiberglass reinforced plastics, premix, vacuum forming, injection and other materials and techniques. **SHOP SUPT.:** Supervision of fiberglass reinforced plastic molding, processes, including hand layup, bag and press molding, fabrication of tooling for such processes. Please send complete resume. We believe these are real opportunities. Replies confidential. Wallace & Tiernan Inc., 25 Main St., Belleville, N. J.

CHIEF ENGINEER.
Must have Engineering education and experience in plastics, capable of general supervision of industrial engineering, estimating, tooling and plant maintenance. Plant does custom and proprietary compression and injection molding. Company entering its 25th. year and expanding. Give complete resume of education, experience and past earnings.
Reply Box 1612, Modern Plastics.

CHEMIST OR CHEMICAL ENGINEER: We have an opening available in our new Research and Development "Plasticenter" for a man with a minimum of three years' experience in phenolic resin. Excellent opportunity. Salary commensurate with experience and qualifications. Reply to Manager, Phenolic Resin Department, Eastern Division, Reichhold Chemicals, Inc., Elizabeth, New Jersey.

VINYL CHEMIST.
Manufacturer calendered film and vinyl sheeting requires experienced chemical engineer or chemist. All replies confidential. Location Midwest. Reply Box 1608, Modern Plastics.

FOREMAN: Experienced in the manufacture of molds for plastics and die casting. Good salary plus extra benefits. An exceptional opportunity to progress with a fast growing company in the Chicago area. Reply Box 1637, Modern Plastics.

WANTED.
Large plastic manufacturer in Massachusetts is looking for a Sales Manager, one who has well-rounded experience plus a knowledge of the plastic business with the future in mind. Opportunity unlimited for right man. Reply Box 1619, Modern Plastics.

PLANT MANAGER: Polyethylene film experience required. Ideal Southern location. Salary to $15,000 plus stock option. Excellent opportunity for right man. All replies treated with strictest confidence. Please submit detailed resume to: Box 1614, Modern Plastics.

PLASTICS DEVELOPMENT ENGINEER.
Excellent opportunity in field of reinforced plastics. College graduate with degree in Engineering or BS, and minimum three years experience in reinforced plastics. Superior working conditions with complete facilities for work in all phases of reinforced plastic development programs. Established manufacturer, Chicago area. Send complete resume with salary desired. Replies held in strictest confidence. Reply Box 1601, Modern Plastics.

VINYLS: We are looking for a Chemical Engineer with the equivalent of at least five years' experience in formulation, development and processing of calendered vinyl compositions. He should be familiar with plant equipment and operations. Press molding experience desirable. A career opportunity exists for a man with leadership potential. Excellent employee benefits with the oldest manufacturer of floor and wall coverings in the country; a nationally known, multi-plant, progressive organization. Forward full resume including salary desired to Warren F. Bietsch, Personnel Administrator, Congoleum-Nairn Inc., 195 Belgrove Drive, Kearny, New Jersey.

CHEMIST OR CHEMICAL ENGINEER.
We want a man with ideas and a broad general knowledge of plastics who can apply his knowledge to development of home building products. Some paper chemistry or paper converting experience desirable but not essential. In reply state education, experience and desired salary.
Bird & Son, Inc., East Walpole, Massachusetts.

Situations wanted

PLASTIC SALES EXECUTIVE: College graduate; conscientious and energetic with an intimate knowledge of polyvinyl and polyethylene extrusions, sheeting and film. Has demonstrated his ability by organizing past positions into highly profitable units. Seeks long-term future with progressive firm. Adaptable to other phases of plastic industry. Reply Box 1636, Modern Plastics.

UNUSUAL COMBINATION: 19 years experience in both making and selling thermo-sets, compression and transfer molded—proprietary and custom. Operated own plant over 8 years. Know general management, overall planning, profitable sales and promotion, efficient production planning and operation, costs and estimates, molds, plant set-up, etc. (B.S.—Chem. Engr.). Reply Box 1647, Modern Plastics.

VERSATILE EXECUTIVE: Degree in Mechanical Engineering. 11 years experience in plastics from project engineer to sales manager. Strong in industrial marketing. Interested in product development. Familiar with all phases of tooling, molding, materials, and allied processes. Can handle assignment either sales or production. Seeking permanent connection with progressive firm. Available after January First. References furnished. Reply Box 1633, Modern Plastics.

CAN YOU USE THIS PRODUCT? B.Ch.E. + M.B.A.:—add six years of experience in Extrusion, Die Design, Coloring, Compounding, Scrap Reclaiming, Injection Molding:—mix with Supervising Production, Production Control, Sales, Purchasing:—stir well, then add Ambition, Conscientiousness, Reliability:—results in a product ready for production or technical service. Reply Box 1629, Modern Plastics.

MECHANICAL ENGINEER: Thirty years manufacturing experience. Past ten years specialized in fiber glass molded parts. Preforming and matched metal molding for quantity production. Have set up two reinforced plastic molding plants now in successful operation. Well versed in product, tool design, manufacturing techniques. Desires consulting with firm planning expansion, entrance into field, product design. Ralph W. Lotz, 6621 Ridgebury Blvd., Cleveland 24, Ohio.

CHIEF ENGINEER, PLASTICS: B.S. Mechanical Engineering. (Young, energetic) 18 years experience, 200 employee plant operation. Hydraulic injection machine designer, development, production, product designer. Injection Molding plant experience, some extrusion. Seeks engineering position with a progressive company. Available January 1, 1957. Reply Box 1620, Modern Plastics.

SALES REPRESENTATIVES: Do you need sales representation in Long Island, New York and New Jersey? We are experienced plastics sales representatives who would like to represent firms that are extruding fluorocarbons, polyethylene and vinyl film, vinyl and polyethylene shapes, plastic coated wire and containers. Competitive price structure is imperative. Reply Box 1600, Modern Plastics.

DESIGNER — INDUSTRIAL: Experience in all phases of Models, Prototypes, and Moldmaking for reinforced Fiber Glass production, and knowledge of design and production. Considerable art background. Varied experience in bag molding, plastic molds, matched dies for pressure casting. Diversified accomplishment in wood, plaster, metal, modeling clay and plastics. New York, Westchester or North New Jersey preferred. Reply Box 1626, Modern Plastics.

(*Continued on page* 302)

(Continued from page 301)

ELECTRONIC HEAT SEALING: Now employed as Plant Engineer; sound theoretical background, varied electro-mechanical experience. Can set up maintenance schedules, build own equipment, make some electrodes and fixtures, make all samples, assist on production problems. Family man. Will Relocate. Reply Box 1639, Modern Plastics.

PLASTIC ENGINEER: Development, experimental production, Thermosetting and Thermoplastic materials. Injection, transfer, compression molding. Mold design; mold and production estimates. Some extrusion experience. Desires responsible position with progressive company. Reply Box 1617, Modern Plastics.

SENIOR MARKET ANALYST: B. S. Degree—Age 34—Desires a position with a New York City or Upstate firm. Carried out and supervised market research projects in the plastics and packaging fields for Modern Plastics Research Corporation and completed sales and market studies for a major chemical company. Applicant possesses a wide range of informative field contacts in the automotive, aircraft, electronics, refrigeration, chemical, and plastics industries. Reply Box 1646, Modern Plastics.

Sales agents wanted

PLASTIC MANUFACTURER'S REPRESENTATIVE WANTED: Substantial, well-rated manufacturer of extruded plastic sheet and film, has opening for high grade established manufacturer's representatives in Cincinnati — Dayton area and Dallas—Ft. Worth area, selling to fabricators and other users. Established accounts, aggressive advertising and sales promotion. Write fully, with particulars including area covered and accounts handled. Reply Box 1631, Modern Plastics.

MANUFACTURERS' REPRESENTATIVE WANTED: By plastic injection molding company. Established firm doing business over 10 years and specializing in nylon molding is looking for representative in Middle Atlantic territory. The specialized nature of the business calls for someone with background in thermo-plastics and its applications. Job could be handled by aggressive concern. Reply Box 1611, Modern Plastics.

SALES REPRESENTATIVE WANTED: By Custom Injection Molding Company. We are Interested in men who are now calling on Industrial Accounts. Located in Midwest with modern and up-to-date facilities. Desirable territories open. Commission basis. Reply giving territory desired. Reply Box 1628, Modern Plastics.

SALES REPRESENTATION WANTED: Internationally and nationally known manufacturer of machines suitable for the pharmaceutical and perfume industry, desires representation in key U. S. cities and surrounding areas. Can carry other non-competitive lines. State in detail present territory coverage, and other lines carried, unlimited field for our equipment. All replies confidential. Chase Companies, 47 E. 19th Street, New York 3, New York.

Miscellaneous

LINE WANTED: Salesman now handling major sundry line to drug chains, drug and notion jobbers in Michigan, Ohio, Kentucky, West Virginia, western New York State and western Pennsylvania wants established proprietary line. Have covered this area for ten years. Started from scratch and have developed a good six figure volume. Reply Box 1641, Modern Plastics.

ARGENTINE MANUFACTURER OF CHEMICAL SPECIALTIES: Excellent manufacturing facilities, closely knit distributing net covering whole country, first class record of aggressive merchandising, long standing, wishes to establish plastic articles producing facilities. Would consider association with U.S. firm contributing know how, machinery, capital or dies. Would also consider your proposal. Interested parties Reply Box 1634, Modern Plastics.

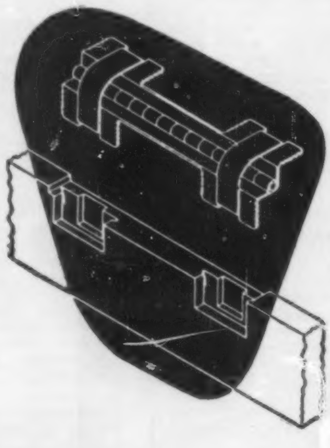
PATENT.
Patent will be issued shortly on new method of combining chemically vinyl copolymers with metallic group. Greatly improved properties for coatings and other applications. Will consider outright patent sale with or without royalties.
Reply Box 1642, Modern Plastics.

PARTNERSHIP WANTED: I have some capital and a wealth of plastic manufacturing know-how, which includes plant set up and training all personnel to operate same. Would like to contact a company interested in investing in a small operation to insure delivery and quality at the right price or would consider individuals with connections with plastics users. Preferred location, Midwest or South. Financial, technical and personal reference gladly exchanged. Reply Box 1627, Modern Plastics.

WANTED: Injection molds—one item or complete line of proprietary consumer articles, also interested in molds for industrial parts such as knobs, handles, fasteners, boxes, etc. Will consider purchasing complete injection plant with end products or parts line. Designers: New items wanted—cash or royalty. Victory Mfg. Company, 1722 West Arcade Place, Chicago 12, Ill.—Estab. 1930.

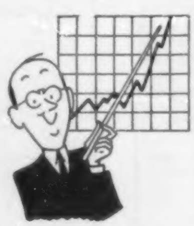
HINGES . . .
for PLASTIC BOXES

press-fit assembly
(Holds like
a drive-screw)
with
or without
double action
"C" Springs



GEISSEL Mfg. Co., Inc.
109 LONG AVENUE
HILLSIDE, N. J., U. S. A.

MAYFLOWER METHODS INCREASE PRODUCTION



Quite frequently our technicians are called upon by fabricators to suggest means of perfecting and speeding up difficult plastic sealing operations. By intense application—by designing and building special equipment—we are most always able to raise quality as well as the rate of production.

4 POSTED "C" PRESS

A standard Mayflower press has 18"x30" flat bed; powered by Mayflower 3½kw. generator. Accurate and highly productive in a widely diversified application of tear sealing.

Mayflower ELECTRONIC DEVICES Inc.
Only Manufacturer of both Bar and Rotary Electronic Heat Sealers
HUbbard 9-9400
20 Industrial Avenue Little Ferry, N. J.


BY APPOINTMENT
TO THE LATE KING GEORGE VI
SCOTCH WHISKY
DISTILLERS
JOHN DEWAR & SONS LTD
PERTH
50 Gold and Prize Medals
50 Gold and Prize Medals
"White Label"
DEWAR'S FINEST SCOTCH WHISKY
OF GREAT AGE
John Dewar & Sons Ltd
DISTILLERS
PERTH
SCOTLAND
70° PROOF
'PERSPEX'
Displays Fine Spirit
'Perspex' is a willing worker for British exports. Here it is, helping to sell one of Scotland's most famous products. 'Perspex' acrylic sheet is just one of many internationally marketed plastics materials made by I.C.I.
This particular bottle, 2 ft. 6 ins. high, is made from 'Perspex' acrylic sheet. The printed label and cap are made from another I.C.I. product—'Darvic' p.v.c. sheet. To Thermo-Plastics Ltd., Dunstable, England, goes the credit for this attractive advertising novelty.
'Perspex' and 'Darvic' are registered trade marks, the property of I.C.I.
ICI
IMPERIAL CHEMICAL INDUSTRIES LIMITED,
Plastics Division : Export Dept., Black Fan Rd., Welwyn Garden City, Herts.
U.S.A. enquiries to : J. B. HENRIQUES, INC., 521 FIFTH AV., NEW YORK 17 N.Y.
Canadian Enquiries to : CANADIAN INDUSTRIES LTD., PLASTICS DEPT., BOX 10, MONTREAL, P.Q.
P.596/OA

Index of Advertisers

December 1956

Modern Plastics, 575 Madison Avenue, New York 22, N. Y.

(Continued on page 306)

(*Continued from page 304*)

New PVC compound stops corrosion!

Discover how rigid polyvinyl chloride pipe, valves and fittings can cut your plant's share of the nation's annual bill for battling corrosion—a staggering $6 billion! You can save on maintenance costs and reduce shutdowns caused by either internal or external corrosion.

Injection molded from a *special, newly developed* DIAMOND PVC rigid compound—the lightweight valve you see above* will resist attacks by weather and a wide range of acids, alkalies, salt solutions, alcohol, and other chemicals.

Easy to install, it's nontoxic, nonsparking and nonflammable. And its smooth inside surface lowers flow resistance and prevents deposit build-ups. Temperature limit for continuous service is 165° F.

Experience further demonstrates that polyvinyl chloride compounds based on this new DIAMOND development are ideally suited to molding operations.

For full information on this remarkable new rigid compound, call or write DIAMOND ALKALI COMPANY, 300 Union Commerce Building, Cleveland 14, Ohio.

*Produced by Tube Turns Plastics, Inc. Louisville, Kentucky. DIAMOND does not make PVC pipe, valves or fittings.

DIAMOND ALKALI CHEMICALS

Diamond Chemicals

In 1975, we'll still be Basic in Plasticizers

. . . AND YOU'LL STILL BENEFIT!

As a plastics manufacturer you already know the day-to-day benefits of buying plasticizers from a basic producer such as Pittsburgh: Complete quality control from coal to plasticizer . . . dependable uniformity of product . . . and prompt, reliable deliveries (perhaps even by helicopter tanker, as illustrated above, in future years!)

But perhaps you've overlooked this most important of all benefits our basic position offers you . . . and it concerns those *future* years. The development of our own raw material sources and plant equipment—from coke ovens to chemical plant—has been achieved over a period of many years, and by a considerable investment in capital and human effort. We have been building, and will continue to build for the future—in production capacity and in our constantly growing research program to provide you with better plasticizers at lower cost.

Don't *you* prefer to do business with a company you know will still be serving you well in 1975?

PITTSBURGH *Job-Rated* PLASTICIZERS

PX-104 DiButyl Phthalate
PX-108 DiIsoOctyl Phthalate
PX-114 Decyl Butyl Phthalate
PX-118 IsoOctyl Decyl Phthalate
PX-120 DiIso Decyl Phthalate
PX-138 DiOctyl Phthalate
PX-208 DiIsoOctyl Adipate
PX-218 IsoOctyl Decyl Adipate
PX-220 DiIso Decyl Adipate
PX-238 DiOctyl Adipate
PX-404 DiButyl Sebacate
PX-438 DiOctyl Sebacate
PX-800 Epoxy
PX-917 TriCresyl Phosphate

PITTSBURGH COKE & CHEMICAL CO.

COAL CHEMICALS • PROTECTIVE COATINGS • PLASTICIZERS • ACTIVATED CARBON • COKE • CEMENT • PIG IRON

Now! AN IMPACT PHENOLIC
that's 4 ways better...
G.E.'s new 12906 Improved Impact Black phenolic molding compound
This new General Electric phenolic offers you an impact material that, in practically every application, is *four ways better* than any known conventional impact phenolic on the market today! G-E 12906 Improved Impact Black pours faster, cures faster, and has taken preheat temperatures up to 290 F with no signs of burning. Filled with woodflour and cotton flock for higher impact strength, it gives a finish superior to conventional impact materials.
Field tests to date indicate enthusiastic acceptance by molders who have tried G-E 12906. They report that its excellent granulation and fast-cure properties make it suitable for use on automatic molding machines. They like its excellent performability and preheatability—permitting high production cycles and uniform pill weights. As for finish, G-E 12906 is reported to give a gloss approaching that of general-purpose compounds.
For more information on G-E 12906 Improved Impact Black, just write to General Electric Company, Section 6C2A3, Chemical Materials Department, Pittsfield, Mass.
Progress Is Our Most Important Product
GENERAL ELECTRIC